

**Effects of in-situ simulation training
intervention on Intensive Care Unit and
Emergency Department nurses' competency
and confidence to ability to perform cardio-
pulmonary resuscitation**

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Effects of in-situ simulation training intervention on Intensive Care Unit and Emergency Department nurses' competency and confidence to ability to perform cardio-pulmonary resuscitation		
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<p>Intensive Care Unit and Emergency Department nurses are responsible for recognizing and initiation of cardio-pulmonary resuscitation. They must keep their competence in Advanced Life Support on applicable level through repetitive training course. It was proven on previous studies that traditional class-room Advanced Life Support training is not enough for retention nurses competence and confidence on appropriate level, and training sessions based on simulation technology is more valuable since it develops nurses' competence and allow to use them in clinical work. Based on the above there is high probability that repetitive mock-code in the workplace can improve the time of initial response during cardiac arrest and change level of confidence among nurses in emergency situations.</p> <p>The aim was to explore effect of in-situ simulation to Emergency Department and Intensive Care Unit nurses' competence and confidence in providing high quality resuscitation.</p> <p>An experimental before-and-after study design was. There was set-up series of in-situ simulations intervention with different frequency from two to six interventions within 3 months with three groups of 20 nurses in Emergency Departments and Intensive Care Units in Almaty and Atyrau.</p> <p>Results demonstrate that in-situ simulations conducted regularly increase nurses' skills and confidence. Knowledge level was effectively maintained by debriefing conducted right after scenario playing. It is also found, that confidence is more related to its initial level, and critical skills rather than to knowledge.</p> <p>As conclusion was stated that in-situ simulation has great capabilities in improving of in-hospital cardiac arrest surveillance by providing to nurses skills and confidence to provide high-quality cardio-pulmonary resuscitation. It would recommend implement that in all clinical hospitals in Kazakhstan and enhance that by selecting potential coaches among the nurses which would further conduct these trainings.</p>		
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1 Introduction

Sudden cardiac arrest (SCA) is considered as one of the most important and meaningful problems in medicine as it is significant in volume and has economic and social impact (Gräsner & Bossaert, 2013). As is known, SCA can be divided into two areas: in-hospital and out-of-hospital. Concerning in-hospital cardiac arrest (CA) only 20 per cent of patients survive while the death-rate is 80 per cent (Go, Mozaffarian, Roger et al., 2013). Cardiac arrest is a life-threatening condition characterized by a total disturbance of blood circulation as result of abrupt cessation of cardiac mechanical function. Specific markers for cardiac arrest include the absence of carotid pulse and the patient gasping or having trouble breathing. It is very important to understand that cardiac arrest is a reversible condition, but only if intervention is performed immediately; if not, it can lead to death (Saklani, White, Klein & Krahn, 2014, 119).

There is almost an equal number of cases of in-hospital cardiac arrests (IHCA) and out-of-hospital cardiac arrests (OHCA) and the main reason for both is cardiac in origin (Moriwaki, Sugiyama, & Yamamoto, 2011). According to the statistics by the American Heart Association (AHA), the total number of OHCA was 366,807 in 2018, which is about 13.5% of all deaths in USA for the same period (Benjamin, Virani, Callaway, et al., 2018). In the United States, approximately 209,000 patients experience an in-hospital cardiac arrest (IHCA) each year (Benjamin, Blaha, Chiuve, et al., 2017) amounting to an incidence of 1.6 episodes per 1000 hospitalizations, and frequency of IHCA in ICU is 52% (Mozaffarian, Benjamin, Go et al., 2016). Also, every year, an estimated 359,400 adult patients in the US and 275,000 in Europe are delivered to the emergency department with CA (Daya, Schmicker, & May, 2015).

Regardless of efforts to improve the “chain of survival” procedure, the lack of the victims’ recovery after IHCA is still an issue. Only 24% of patients after IHCA are discharged from the medical facility (Benjamin, Blaha, Chiuve, et al., 2017; Daya et al., 2015) and about 14% of them suffer from serious neurological deficiencies (Benjamin, Blaha, Chiuve, et al., 2017). Therefore, the following procedures heavily influence the patient's survival after cardiac

arrest: quick diagnostic of Cardiac Arrest (CA), instantaneous initial response, and performing high quality CPR (Meaney, Bobrow, Mancini et al., 2013).

On the other hand, Curran, Fleet and Greene (2012) in exploratory study of factors influencing resuscitation skills retention and performance among health providers have proven that if Health Care Workers (HCWs) well done an exam by Basic Life Support (BLS) or Advanced Life Support (ALS), it is not provided a successful performance and participation their during a real emergency situation. Moreover it was proven that nurses achievements in CPR are received during training course are reduced while two weeks after end of class (Curran et al., 2012). That is why a mock code training lets HCWs to remember and improve CPR skills, these exercises are able to retain nurses knowledge and achieve appropriate level of CPR maneuvers and a better level of confidence under patient resuscitation (Curran et al., 2012; Delac, Blazier, Daniel, Wilfong, 2013). Therefore, the purpose of my research is to explore nurse's knowledge and skills on advanced life support in Intensive Care Unit and Emergency Department in order to determinate how in-situ simulation training intervention will influence nurses' confidence and ability to perform CPR.

2 The role of nurse's competence and confidence in high-quality CPR

Intensive Care Unit (ICU) and Emergency Department (ED) nurses are the initial line of HCWs who has been witnessed of IHCA. Moreover, indications to BLS due life-threatening conditions are identified by nurses. So, they must keep their competence in BLS and ALS on applicable level for saving patients life successfully. Nevertheless not all patients after cardiac arrest are able to return to spontaneous circulation on the grounds of lack nurse's skills on primary evaluation, knowledge gaps in protocol of treatment and inappropriate monitoring of resuscitation (Rajeswaran & Ehlers, 2014).

Looking after instability patients with significant worses of vital sings and frequently IHCA number, ED and ICU nurses extremily need enchance their CPR skills, cognitive function and critical thinking permanently. To achieve improvement quantity of survival, nurses should to retain their skills in ALS,

have a fast reaction in emergency situations, be able to identify cardiac arrest more quickly and perform emergency care in appropriate level (Girotra, Nallamothu, Spertus, Li, Krumholz, & Chan, 2012).

However, nurses have still experiencing certain level of fear during CPR and have to rough going call to remembrance and perform practical skills desired for management of emergency cases. As a consequence of that, low level of nurses' confidence slows down their initial response to life-threatening conditions and can compromise patient's safety and lead to worse outcomes (Delac et al., 2013). Therefore, ED and ICU nurses need to attend the trainings repeatedly to refresh their skills and improve their competence in CPR (Palhares, Palhares, Dell'Acqua & Corrente, 2014). It is also valid for their ability to recognize life-threatening conditions, initiate early CPR and defibrillation in emergency situations.

2.1 Retention of nurses competence in CPR

The initial steps of CPR are well known to each HCW and consist of chest compressions and breaths. High-quality CPR increases the possibility of the patient's survival, especially if CPR is performed according to the following instructions: start chest compressions within 10 seconds of the onset of cardiac arrest; deliver appropriate rate of chest compressions, which is about 100 to 120/min; the depth of chest compressions should be five to six centimeters for adults; and give two breaths with appropriate volume of air and avoid leaning on the patient's chest, making sure that the patient's chest is rising (Basic Life Support (BLS) by American Heart Association (AHA) (2016).

First attention should be paid on the retention of practical skills and knowledge of nurses and the schedule of training courses. In the "traditional" education model, healthcare professionals have to pass an exam for BLS certification and then repeat the course every two years to renew the certificate. The certification consists of classroom teaching with a video-based course and a simulation scenario in a simulation center. However, the American Heart Association (AHA) 2015 CPR Guidelines is determined that the two-year pause in training is too long (Bhanji, Donoghue, Wolff, Flores, Halamek, Berman, Sinz, Cheng, 2015).

At the same time, there is absolutely different situation in Kazakhstan. In accordance with "About establish rules of specialists certification in healthcare field" Order of Healthcare ministry and social development Republic of Kazakhstan 693 (2015) nurses obliged to be re-certificated and attend recurrent training courses only every five years. Also, most of the training courses include theoretical part only (lectures and slide-presentations) and do not allow to improve the practical skills. Moreover, regular practice of BLS and Advanced Cardiovascular Life Support (ACLS) training courses obligatory for each nurse in Kazakhstan every 2 years is not implemented.

At present, healthcare workers (HCW) who participate in CPR following cardiac arrest must attend recurring short-interval education courses (Chu & Tracey, 2018). Repetitive frequent training in BLS and retraining in ALS may be useful for HCW who are likely to face patients with cardiac arrest (Bhanji et al., 2015). In a mixed-method, explanatory study (Curran et al., 2012) it was found that the skills learned in CPR training were only sustained for about two weeks, after which they started to progressively deteriorate, with significant deterioration of these skills revealed six months after training. At the same time, Aqel and Ahmad (2014) were revealed that CPR mechanical attainments and lore are greatly reduced three months after appropriate training. The same experience was gotten by Rajeswaran and Ehlers (2014) due a quasi-experimental time-series study in Botswana. ICU and ED Nurses CPR knowledge and practical skills were explored by researchers through writing tests (pre-test, post-test, and re-test) and one CPR training. Re-test were passed by nurses three month later after education. Rajeswaran and Ehlers were reported that no one nurse passed writing pre-test. Therefore, they investigated that nurses CPR competence was enhanced after intervention (training), but post-test was conducted three month later had revealed degradation knowledge (Rajeswaran & Ehlers, 2014).

However, two Swedish hospitals conducted a study on the effect of CPR and automated external defibrillator (AED) training on the self-perceived attitudes of health-care professionals towards performing resuscitation. The results showed that HCW, particularly nurses, were able to improve their attitudes toward CPR and increase their level of knowledge after the training (Kallestedt, Berglund, Herlitz, Leppert, & Enlund, 2012).

Several weaknesses have been recognized in the classical system of education for HCW. Comparing the time period of the deterioration of Advanced Cardiovascular Life Support (ACLS) skills and BLS skills is revealed that ACLS skills are lost faster. Moreover, a traditional BLS/ACLS class does not compare to a real emergency in a medical facility (Huseman, 2012). Indeed, Curran et al., (2012) state that the active participation in BLS/ACLS courses does not assure that HCW will be able to remember course content and use it successfully when faced with a real life-threatening situation.

However, Kim, Park, and Shin (2016) state that a simulation-based learning method plays a significant role in teaching nurses motor skills. Therefore, a suitable type of simulation training should be chosen in order to reach the educational aims and outcomes. Nevertheless, nurses who do not encounter a cardiac arrest every day would be able to change their attitude to CPR, decrease their fears and increase their confidence through participation in a training simulation. Permanent repetitive learning programs can lead to a positive change in healthcare workers' attitudes toward BLS. Moreover, a correlation has been found between healthcare workers' participation in previous BLS courses and their attitude and level of concern towards CPR. More specifically, the most experienced HCWs have more positive attitudes and not as much concern towards CPR and AEDs than HCWs with less experience (Abolfotouh, Alnasser, Berhanu, Al-Turaif & Alfayez, 2017). Therefore, the maintenance of HCWs competence in CPR and ALS is a continuous process that requires an appropriate level of education and that is not limited to classroom teaching. Furthermore, it is preferable that nurses take part in simulation more frequently than once in every two years. Indeed, Lund-Kordahl, Melau, Olasveengen, Sunde & Fredriksen (2019) found that high quality of CPR is directly dependent on BLS course degree. The study also reported that the most critical components of CPR, such as ventilations and hands-on time, were also the most dependent by the level of preparedness resulting from training. Allen, Currey, and Considine (2012) have demonstrated in their research that annual evaluation of resuscitation knowledge and skills is not reliable; there was no correlation between theoretical knowledge, CPR mechanical skills and annual assessment scores since both knowledge and skills are degraded earlier than in one-year period.

At the same time, there was found advantage in repeating of training sessions based on simulation technology (Allen et al., 2012)

As demonstrated by these examples, BLS training and refreshing of skills and knowledge is crucial for increasing the HCWs confidence and ability to perform CPR when needed. Moreover, not only medical professionals should be involved in the continuous education process - the administration should have an interest as well (Abolfotouh et al., 2017). Espíndola, Espíndola, Rodrigues de Moura & Andrade de Lacerda (2017) has evaluated ICU nurse's competence in CPR through a descriptive, exploratory, quantitative study. In result 33,33% of ICU nurses only were able to detect SCA correctly. So, importance of CPR trainings for nurses was proven by the data collected (Espíndola et al., 2017).

Recurrent BLS courses are also strongly recommended for increasing the quality and time of initial response and the preparedness for emergencies in the workplace, in other words, to increase nurses' ability to perform high-quality CPR in critical situations. Furthermore, they give a chance to increase positive outcomes after cardiac arrest as well as encourage inter-professional collaboration in healthcare facilities (Shehata, 2016). The study of Vural, Koşar, Kerimoğlu, Kızıkan, Kahyaoğlu, Tuğrul & İşleyen (2017) found that CPR skills should be improved through special training programs at regular intervals. In addition, nurses' knowledge and competence should be re-evaluated regularly according to the actual resuscitation guidelines.

2.2 In-situ simulation intervention training for enchasing CPR skills

In situ simulation (ISS) is a modern method of educating ED and ICU nurses in their workplace. ISS has become the most requested method. As far as nurses encounter emergency cases daily, ISS could bring a positive impact on patient safety through the development of nurses' basic skills and help improve communication and teamwork among HCW (Rosen, Hunt, Pronovost, Federowicz & Weaver, 2012). The main goal of ISS is developing teaching strategy focused on improving professionals' competencies and interdisciplinary interaction practice in order to enhance patient's protection.

Concerning patient safety, ISS education could help to reveal gaps and weakness of clinical systems and identify problems of staff who participate in resuscitation (Villemure, Tanoubi, Georgescu, Dubé & Houle, 2016).

Furthermore, ISS is simulation that is provided in a real clinical environment and where involved participants are on-duty in their workplaces during simulation (Walker, Sevdalis, McKay, Lambden, Gautama, Aggarwal & Vincent, 2013). Usually, simulation training activities depend on the level of fidelity of the manikin (Levett-Jones, McCoy, Lapkin, Noble, Hoffman, Dempsey, Arthur & Roche, 2011).

The high-fidelity clinical scenarios, based on ISS in nursing, can educate newcomers as well as experienced nurses by supporting them in developing effective communication and collaboration skills, training them in emergency cases, and providing them with a variety of real life-threatening conditions through simulations (Kim et al., 2016). For most HCW who attend CPR courses, cardiac arrests and resuscitations is not a part of their daily work. Therefore, simulation scenarios have become an important component of nurses' training concerning preparedness and performance in real life emergencies (Moazed, Cohen, Furiasse, Singer, Corbridge, McGaghie, & Wayne, 2013).

Some studies have made recommendations for the appropriate schedule (frequency, length, and time) and agenda for ISS. Initial findings of Delac et al., (2013) revealed that in-situ medical emergency team/code simulation followed by debriefing improved the performance of responders. After Five Alive course, where 250 nurses participated, the hospital offers four 1-hour sessions every month, which has been found an effective training tool. It has been found challenging to offer the program during the off-shift and weekends, when HCW would be better focused on their performance and tasks in the simulation (Delac et al., 2013).

The advantage of ISS training are that nurses can detect place of necessary medical equipment and use it appropriately, improve time of initial response and time of first chest compression, develop communication skills. Therefore, one of the main benefits of ISS training is a realistic and interactive training environment. Participants have a chance to develop their critical thinking and reflect on the availability of necessary resources (Delac et al., 2013). ISS with

mock code scenario is able to reduce time of initial response and improve level of HCW confidence. In situ mock codes are simple and working method to train CPR mechanical skills and permit to nurses collaborating as one team (Reece, Cooke, Polivka & Clark, 2016). ISS trainings are demonstrated successfully development level of competence and transfer them into clinical area (Smith & Andersen, 2014).

2.3 Mock-code programs' added value for continuous education in the workplace for nurses' skill retention and preparedness for emergencies

When examining the influence and benefits of using mock-code or code blue in the workplace, several success factors can be recognized. According to Herbers and Heaser (2016), in-situ simulation (mock-code) is one of the most applicable modern methods of education for nursing staff. It can help to achieve good results by hands-on practice for the improvement of nurses' muscle memory and to let HCWs develop and fix their skills in team player roles. Moreover, a repetitive mock-code in the workplace can improve the time of initial response during cardiac arrest and lead to an increased level of confidence among HCWs in emergency situations. According to Reece et al., (2016) the mock-code scores were meaningfully higher if participants attended the simulation during day-time and by nurses who had been more confident in their CPR skills.

An implementation of an in-situ mock-code program in medical facilities has given a chance for effective collaboration between other units and allowed medical staff to recognize mistakes and evaluate their experience and personal value as well as the importance of participation. The result of the study Roth, Parfitt, & Brewer (2015) implicates that in-situ mock-code is an actual and resultative method of permanent self-development, increasing of self-confidence, self-satisfaction, and education for nursing staff. In-situ mock-codes are a better solution for team work improvement and possibility for HCW to conduct hands on training in short-time period (Reece et al., 2016). Also, several studies were found positive dynamic in level of nurses confidence and supervising and facilitation abilities after attendance in mock codes trainings (Curran et al., 2012; Wehbe-Janek et al., 2012; Roth, Parfitt, &

Brewer, 2015; Reece et al., 2016). However, nurses frequently had concerns and their roles were not clear for them during emergency situations. In a study by Hunziker, Pagani, & Fasler (2013), initial response was delayed because nurses were confused and expected the physician's instructions.

The mock-code (code blue) programs are typically used for ISS training. Normally the mock-code session is delivered in a realistic training environment, for example, in different places of medical facilities such as the washroom, waiting room, or patient room (Kallestedt et al., 2012; Daya et al., 2016). Thus, nurses are able to significantly improve their level of confidence and practical skills through mock-code simulation (Huseman, 2012; Delac et al., 2013). Two approaches have been explored in mock-code research: whether conducting mock-code without preliminary training intervention (Curran et al., 2012; Huseman, 2012) or after preparatory training intervention before mock-code. Both improved performance during resuscitation (Wehbe-Janek et al., 2012, Roth et al., 2015). In general, medical facilities where patients stay for shorter periods had more experienced nurses who also received higher mock-code scores during simulation than other nurses. In both studies specific improvements were found, such as an increase in the level of HCWs confidence or quality of performance during mock-code, for example, reduction in the time of initial chest compression (Curran et al., 2012; Huseman, 2012). In a quasi-experimental study by Huseman (2012), nurses were educated through simulation of cardiac arrest. Mock-code training had been provided for three months and two important things were achieved: HCWs first chest compression was 25 per cent quicker ($t(27)=2.8$, $p=0.0079$) and epinephrine was administered 23 per cent quicker than before ($t(27)=4.6$, $p<0.0001$). Thus, it can be concluded that in situ-mock codes significantly improve response times and increase staff confidence levels. Furthermore, Shehata (2016) has provided data proving the efficacy of in-situ simulation for nurses. Therefore, medical facilities may consult this data to make essential changes in their internal CPR policies.

2.4 Nurses Confidence and Self-confidence during resuscitation

Confidence plays significant role for nurses and their routine work. For an example, confidence helps to nurse to make decisions quickly and to not hesitate at the important moments of patient management and finally to achieve better results in collaboration and interaction with patient and his\her next-of-kin.

2.4.1 General concepts of confidence

There are interconvertible terms are met in nursing literature as confidence and self-confidence (Perry, 2011). Definition of Confidence was given by Holland, Middleton & Uys (2012) as a permanently changeable personal conviction has been formed during nurse's professional life and included self-understanding, meaning of personal competency, meet own expectations. Moreover, following words typically are used as substitute: Confidence, self-confidence, professional confidence and self-efficacy (Brown, O'Mara, Hunsberger, Black, Carpio & Noesgaard, 2003; Holland et al., 2012). In other hand Perry (2011) has suggested considering nurses confidence as a self-belief to reach a result on their own. Nurse's judgments, mentality and thoughts are relying on their confidence (Perry, 2011).

In nursing self-efficacy is including confidence and ability to practice influencing patient care (Willetts, Hood & Cross, 2015). Therefore confident nurses are able to increase self-efficacy and to conduct something better than other colleagues, and reach some positive results. Moreover level of confidence is influenced on education process and ability to learn and on further nurse's achievements (Perry, 2011). Normally, HCWs who are prepared, educated and participated in emergency situation should have appropriate level of competence and confidence as well to perform resuscitation. Although mechanical skills of CPR look easy, some nurses have lack of confidence to start resuscitation, just because their knowledge was not refreshed frequently enough (Adekola, Menkiti, & Desalu, 2013).

2.4.2 Influence a nurses' self-confidence on practical skills and work

Verplancke, De Paepe, Calle, De Regge, Van Maele & Monsieurs (2008) have proven that nurses with higher level of self-confidence are performing all necessary interventions and steps of management during cardiac arrest more quickly and correctly than their co-workers with low level of confidence. Therefore a low level of confidence during BLS and ALS is considered as one of significant issue in nursing practice and can influence in nurses ability to perform resuscitation appropriately (Hickman, 2016). According to Curran et al., (2012) study the confidence could be increase through actual discussion session (debriefing) with participants of resuscitation. Low level of confidence was revealed if HCWs have not had clear roles and designated Team leader, who would facilitate and efficiently collaborating with each team member. Moreover, Pfaff, Baxter, Jack & Ploeg (2014) are explored a new theory concerning clinical cases for example development of confidence with regard to inter-professional collaboration (Pfaff et al., 2014).

Curran et al., (2012) has proven that better level of nurses confidence and ability participation in CPR would revealed if they had been attended in refresh CPR course before intervention and if nurses would have debriefing after each their mock-code performance. Reece et al., 2016 has evaluated the correlation between Code Component Self-Confidence results and mock code evaluation scores and found a statistically significant relationship between these variables ($r=0.28$, $p=0.035$). Alpha was set a priori at 0.05 (Reece et al., 2016). Consequently a positive dynamic was revealed in both types of trials. There were increase level of nurses' confidence and initial response time (Curran et al., 2012; Huseman, 2012; Reece et al., 2016).

2.5 Methodology of evaluation nurses confidence and skills

In order to determine appropriate type of research and evaluation method of nurses confidence and influence of ISS on nurses competence were analyzed several previous studies. The criteria of choosing of the references were the next: full-text English language articles published between 2012 and 2019.

Following results were received. Firstly were explored studies of Mock code with ISS. All research were split into two large group: 1. trials were focused on improvement of CPR skills through of mock codes simulation without educational intervention (Watson et al., 2011; Curran et al., 2012; Huseman, 2012; Herbes & Heaser, 2016), and 2. researches were focused on influence in CPR Skills through combination of mock-code simulation and CPR-education course (Wehbe-Janek et al., 2012; Aqel & Ahmad, 2014; Roth et al., 2015; Reece et al., 2016; Beament & Venville, 2016; Pisciotani, Rocha, Costa, Figueiredo & Magalhães, 2017). Consequently a positive dynamic were revealed in both type of trials. There were increase level of nurses' confidence and initial response time (Curran et al., 2012; Huseman, 2012; Reece et al., 2016). The following methods and maneuvers have been adapted in this research: used "0= definitely cannot able to do to 100=absolutely exactly can do" scale as tool for self-evaluation nurse's confidence, closed and open-ended question were used (Curran et al., 2012).

Herbes and Heaser (2016) have increased nurse's confidence and knowledges through implementation of ISS mock-code program on two progressive care units at Mayo Clinic Hospital–Rochester, St Mary's Campus. Thereby the program has been conducted for two years in vascular and thoracic surgical progressive care units. The frequency of ISS mock-code was determined as quarterly; researchers were focused on two significant points: level of nurses' confidence and initial response time during emergency situation. Moreover, in order to determine initial level of nurses' confidence (before intervention) an electronic survey was performed for each participant of the program. Second survey was conducted in two weeks after the first mock-code completion among nurses participated in the ISS program. There were three questions focused on nurses' ability to perform CPR, participate in resuscitation process and their ability to be a team leader during an emergency situation. The variants of answers were classified as strongly disagree, disagree, agree, and strongly agree. The χ^2 was chosen to detect dynamic changes of responses between initial and further levels of nurses' confidence after mock-code interventions. Moreover, the Fisher exact test was used to determine dichotomous variables of pre and post confidence surveys (Herbes & Heaser, 2016).

On other hand Reece et al., (2016) has explored the interdependence between mock-code results, specific of nursing subdivision variables, and features of nurses reaction to mock codes (nurse's responder variables) on descriptive study. By researchers, they have proposed to nurses to evaluate their self-confidence in responding to in-hospital resuscitation events anonymously before and after the mock codes. In order to determine level of confidence among nurses, they have evaluated their personal self-confidence in participating in in-hospital emergency management before and after the intervention (mock-code). Moreover, nurses have passed through the Code Component Self-Confidence survey and evaluated current level of confidence in eight key-points of CPR: check for patient's response (consciousness); carotid pulse detection; initiation of chest compressions and ventilation; delivering of defibrillator; placing of the patient; right positioning of sticky pads; using of AED/defibrillator; and appropriate timing and record keeping. Each key-point was ranged on a 5-point scale (1=Not at all confident, 5=Very confident). Statistical analysis has been conducted using a Pearson correlation coefficient.

Pisciottani et al., (2017) have performed an experimental study by quantitative approach. Researchers have explored how frequency of ISS mock code intervention would affect nurses' knowledge in CPR and their confidence in each of three groups and compared their results. Pisciottani et al., (2017) have split all participants on three groups randomly after initial theoretical ALS course; each group was passing through ISS mock-code according to a personal schedule of interventions. First group of nurses has had the general schedule of intervention. It was including the following: first intervention done at the start of study and one more intervention over eight months followed by evaluation of the outcomes. Second group was subjected to two interventions in addition to the schedule of the First group (once in every four months). Third group has passed the intervention every two month (four sessions) in addition to general schedule. Each nurse has been evaluated using the checklist and researchers have assessed dynamic of each participant's skills and perception during cardiac arrest as well. Student's t-test and Chi-Square test were used further by researchers for data analysis and searching for comparability among results of three groups. Moreover, researchers have evaluated nurses' perceptions of their abilities and skills at CPR by a

questionnaire. The content of this tool was based on a Likert-type scale and the questionnaire has been used twice: before and after the ISS (Pisciottani et al., 2017).

At the same time, Beament & Venville (2016) has been explored the influence of a high-fidelity mannequin simulation on level of nurses' student confidence in ability to conduct CPR in descriptive study. Researchers has chosen questionnaire with quantitative and qualitative items as tool for data collection before and after eight weeks of intervention (BLS course with simulation on mannequin). The main goal of survey was to determine the level of confidence in ability to perform CPR on mannequin by nurse's student. Students' confidence was accessed in accordance with their awareness of theory of CPR, their performance during simulation and in real clinical environment (Beament & Venville, 2016).

Summarizing all the above, the research has been designed as a series of ISS trainings conducted in ED and ICU of two multidisciplinary hospitals in Atyrau and Almaty (Kazakhstan). The levels of knowledge, skills and confidence in providing CPR have been evaluated before the interventions and after each intervention in order to find out whether there is any positive or negative dynamic and how much is it. Three groups of ED/ICU nurses have passed different numbers of the training sessions of same design to find out whether there is a relation between number and frequency of the sessions and observed dynamic of confidence and competence (if there it is). Written test was used to evaluate knowledge; checklists—for skills and questionnaire—for confidence. Each of the tools above had a scale to provide possibility of quantitative evaluation and comparison of the results. The details of these are presented in the topic Research design below.

3 Purpose, Objectives, and Research Questions

The purpose of this research is to explore nurses' knowledge and skills on advanced life support in ICU and ED in order to determinate how in-situ simulation training intervention will influence nurses' confidence and ability to perform CPR.

The objectives of research are to study the effect of in-situ simulation training intervention on ICU/ED nurses' competency to perform CPR and to determine the level of confidence to start CPR among ICU/ED nurses after an in-situ simulation training intervention.

The research questions are:

What is the effect of in-situ simulation training intervention for confidence and competence (knowledge, skills) of ICU and ED nurses and their ability to perform CPR?

How does the level of confidence and competence (knowledge, skills) of ICU/ED nurses change in performing CPR after a three-month in-situ simulation training intervention?

4 Study design

Based on the research questions, objectives, and purpose listed above it was decided to design the study as a quantitative research since they are all directed to explore how in-situ simulation training intervention will influence nurses' confidence and ability to perform CPR in a population of ED and ICU nurses of two hospitals in Kazakhstan by comparing the interventions rather than understanding how the intervention was perceived and experienced by patient or nurse (Health Research Authority, 2013). The main goal of quantitative research is to feel certain that any results are valid and reliable (Silverman, 2011, 34; Topping, 2015, 163; Polit & Beck, 2012, 17).

Why exactly have ED/ICU nurses been chosen to test impact of in-situ simulation to their competence and confidence? According to Bandiera, LeBlanc, Regehr, Snell, Frank & Sherbino (2014), the education model of ALS for HCWs allows to completely plunge into learning in the workplace. This area is an applicable discipline for studying a new method of education as well. There are two most suitable methods: simulation and team-based model education.

There are two main competencies: early recognition of a medical emergency and early intervention. Capability for further education is upgraded by this method as well. Moreover, the nurse's role in emergency and critical care has

changed significantly in recent years. Nurses have become leaders, playing the main role in patient care and primary assessment. Nurses in ED do not work alone; they are efficient team-players and team-leaders. Appropriate knowledge/skills and quick response to an emergency were recognized as the key competences of ED nurses. It is required to know personal limitations and to have some level of confidence. Repeated simulations with accent to teamwork are recommended to develop the skills in each possible role and in effective team dynamic (Jones, Endacott and Crouch, 2003, 1-9). The emergency department can be considered as a test site for education and ISS as well as a headliner for the preparing and teaching of medical personnel (Bandiera et al. 2014).

4.1 Implementation of study design

An experimental before-and-after study design was chosen as version of quantitative approach. This type of design was applied in order to reveal the difference between outcomes (dependent variables) of three groups of participants and an influence frequency of ISS interventions (independence variables) on them. Nurses' confidence and competence (knowledge and practical skills) were considered as depended variables and have been measured before, immediately after intervention, and at the end of study. Dependent variables in current experimental study were measured by special tools (ALS-knowledge assessment MCQ written test, ISS skills checklist and Self-evaluation questionnaire of a nurse's confidence) in order to determine an initial level of nurses' confidence and competence, dynamic of their changes, and evaluation of outcome. Therefore, the quantitative method research was applied through quantitative data collection and analysis in single study for exploring nurses' knowledge and skills on advanced life support in ICU and ED in order to determinate how in-situ simulation training intervention will influence nurses' confidence and ability to perform CPR.

The population sampling was used for representability. In order to involve participants in the study, sixty nurses (n=60) were chosen randomly from 110 nurses. There were forty ICU and ED nurses (n=40) in Almaty City Emergency Hospital and twenty ICU and ED nurses (n=20) in Atyrau Oblast Hospital. Data was collected from May 2018 till December 2018 after the approval of the

ethical committee of Kazakh Medical University of Continuing Education (KazMUCE) and agreement with medical facilities, administrations and gathering consent forms from each nurse who voluntarily participated in research.

All nurses have been divided in three groups with equal number of participants. There were twenty ($n=20$) nurses in each group. Nurses from Almaty Emergency Hospital were split into first (ALA-A) and second groups (ALA-B) randomly, and nurses from Atyrau Oblast Hospital were included in the third group. Moreover, each group was separated into four subgroups which consisted of 5 participants ($n=5$) (See Figure 1) for playing different in-situ simulation scenarios.

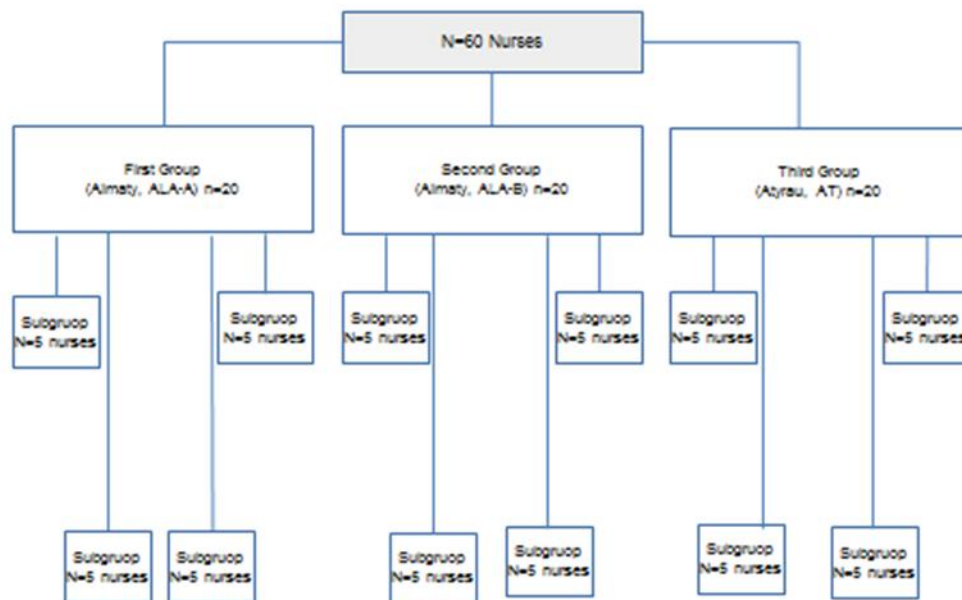


Figure 1. Division of research participants into three groups and twelve subgroups

An experimental study was conducted through series of interventions with different frequency for each group (See Table 1). Before intervention was started, preparation stage was provided. An initial assessment of nurses' ALS theoretical knowledge through Multiple Choice Question (MCQ) written pre-test was performed. Then an initial level of confidence was self-evaluated by nurses through Likert-type confidence questionnaire of seven questions. Also,

general information about participants of study was gathered by General questionnaire form as well. The next step of preparation stage was ALS training for nurses which was conducted regarding data of previous researchers (Wehbe-Janek et al., 2012; Aqel & Ahmad, 2014; Roth et al., 2015; Reece et al., 2016; Beament & Venville, 2016; Pisciotanni, Rocha, Costa, Figueiredo & Magalhães, 2017). Therefore, each subgroup attended four-hours ALS training for nurses (eight sessions in Almaty and four sessions in Atyrau) based on the Sudden Cardiac Arrest protocol Republic of Kazakhstan 2016 (Maltabarova, Sarkulova, Alpyssova, Kokoshko, Akhilibekov, Sartayev, & Dussembayeva, 2016). The content of training included a combination of a Power Point (ppt) slide-presentation, short learning video and practical part with a high-fidelity mannequin (Rescue Anna), Automated External Defibrillator (AED), manual defibrillator, cardio-monitor and equipment for airway management and Intra Venous (IV) access. Also, two persons were invited to observe during ISS scenario and conduct initial ALS training to avoid deviation of final results interpretation due to researcher's influence (one for Atyrau Oblast Hospital and second for Almaty emergency hospital). Both of them have been certified as instructors by AHA.

The intervention took one hour and fifteen minutes and enclosed the following:

- 1) Twenty-minutes high-fidelity in-situ simulations with twenty minutes debriefing after each session
- 2) Evaluation of ISS performance by ISS skills checklist (observer has been assessed during ISS)
- 3) Theoretical knowledge evaluation by ALS-knowledge assessment MCQ written test after each ISS scenario (20 minutes)
- 4) Evaluation of nurses' confidence level by Likert-type self-evaluation questionnaire of nurses' confidence (15 minutes)

Each group has had their personal schedule of intervention (See Table 1) in order to determine what frequency of intervention will be more appropriate and influence mostly on level of nurses' confidence and competence in CPR. The schedule of intervention was created regarding results of previous study and included a time-interval of two weeks (Curran et al., 2012), one month (Delac et al., 2013) and three months (Aqel & Ahmad, 2014; Rajeswaran &

Ehlers, 2014). Study interventions were conducted with six specially designed simulation scenarios based on Megacode scenario by Advanced Cardiovascular Life Support (ACLS) by American Heart Association (AHA) (2015) and Sudden Cardiac Arrest protocol Republic of Kazakhstan 2016 (Maltabarova et al., 2016).

First group (ALA A) interventions was conducted six times (immediately after training and every two weeks for three months). Second group (ALA B) interventions was four times (immediately after training and once a month for three months). Third group (AT) interventions were conducted two times (immediately after training and once three months after first intervention). First (ALA A) and second (ALA B) groups were in Almaty and third (AT) was in Atyrau. In each group, participants were allocated into four subgroups (5 nurses).

Table 1. Schedule of interventions

No	1 th intervention	2 th intervention	3 th intervention	4 th intervention	5 th intervention	6 th intervention
ALA A	+(immediately after ALS training)	+(2 weeks)	+(2 weeks)	+(2 weeks)	+(2 weeks)	+(2 weeks)
ALA B	+(immediately after ALS training)	-	+(1 month)	-	-	+(1 month)
AT	+(immediately after ALS training)	-	-	-	-	+(3 month)

Five participants of each group were assigned in the following roles during in-situ simulation: a participant in the ventilation; a participant in chest compressions, time-recorder; participant for administration medications and establish intravenous access, a participant operated defibrillator was combined the team leader responsibilities as well. The aim of in-situ simulation scenarios was to familiarize participants with the environment, real medical devices and equipment in ICU and ED; involve them in real-time simulation on a high-fidelity mannequin and demonstrate their practical skills on it.

Therefore, a separate scenario has been created for every intervention (total number were six scenarios), which were provided for each group according to the schedule (See Appendix 2). The in-situ simulations have been conducted during the day-shift of participants, a maximum duration of each ISS was 20 minutes and in addition 20 minutes were taken for debriefing immediately after each simulation. Therefore, after each ISS intervention, nurses had a chance for self-reflection and self-evaluation of their performance and discussed what was done well or badly, what went wrong. Also, they could find a solution for further self-improvement in order to enhance their theoretical knowledge and practical skills at a future interventions.

4.2 Population and sample

The population of study was included licensed nurses who have been working in ICU and ED in Almaty City Emergency Hospital and Atyrau Oblast Hospital. One important condition of quantitative research is to collect samples that are representative of the focal population in order to allow generalization so here the population sampling was used for representability (Hunt & Lathlean, 2015, 175). All participants were chosen through random method of lottery and a personal identification number was assigned to each nurse. Therefore, for the first group it was numbers from ALA A1 till ALA A20, for second group ALA B1-ALA B20, for third group AT1-AT20. In turn, each group was divided into four subgroups randomly by using the lottery method. The inclusion criteria were Registered Nurses who work in ED and ICU and who are ready to take a part in the research and have a valid certificate of specialist for work. The exclusion criteria were vacation, maternity leave, and/or expired certificate of specialist for work at the time of sampling.

4.3 Data collection instruments

There were four data collection instruments in this study. The first tool was the General Nurses Questionnaire in order to collect the demographic and general information about participants of research (See Appendix 3). There were thirteen questions about age, nurses' education, the length of work experience, previous BLS and ACLS training, attending on ISS scenarios,

certification, resent participation in real IHCA/CPR events. Each participant completed the questionnaire in the beginning of the study.

The second data collection instrument was ALS-knowledge assessment MCQ written test. It was applied to each nurse in order to evaluate initial theoretical knowledge of participants and then to re-evaluate their knowledge during the research process regarding intervention schedule (See Table 1). There were twelve multiple choice questions focused on ALS and CPR, IHCA and management of life-threatening conditions (See Appendix 1). Each question has had four possible answers and only one answer was correct. The ALS-knowledge assessment MCQ written test score requirement was determined as at least 83% and maximum score was 100%.

The third tool of data collection was presented as Self-evaluation questionnaire of the nurses' confidence (See Appendix 4). The questionnaire was based on Likert-type scale (Wade, 2006). Thus, there were seven statements regarding nurses' perception of their ability to participate in CPR, being useful during IHCA, awareness of CPR technique, ability to initiate CPR with following range of agreement: 1–Strongly disagree, 2–Disagree, 3–Neither agree or disagree, 4–Agree, 5–Strongly agree. Dynamic nurses' self-confidence has been assessed regarding the schedule of intervention (See Table 1). The maximum score was 5.0, the minimum was 1.0.

The last instrument of data collection was ISS skills checklist (See Appendix 5). It has been used to evaluate nurses' performance at ISS. The evaluation of practical skills was conducted by certified BLS and ACLS instructors who would not gather other data. Each participant has been assessed individually for better understanding the benefits and retention of his/her skills. There were critical points of assessment tool with proper value for each point, the score requirement was determined as at least 83% and maximum score was 100% Overall maximum score and pass score were the same as in the written test. Each critical point of the checklist had its own value: initial response (4%), primary assessment (10%), CPR (81%) and general impression (5%). At the same time, three from six CPR sub-points were chosen and one critical point (Primary Assessment) which were determined as the most valuable, based on requirements of Basic Life Support (BLS) by American Heart Association (AHA) (2016) and Sudden Cardiac Arrest protocol Republic of

Kazakhstan 2016 (Maltabarova et al., 2016). All other less valuable sub-points of CPR were contained to 25%.

- 1) Primary assessment–10%. Time for recognition of cardiac arrest: no more than 10 seconds.
- 2) The quality of Chest Compression (CC)–20%. Most important triggers are delivering thirty CC for 15–18 second, correct hands placement and the depth of chest compression 5–6 cm; time period from diagnostic cardiac arrest till first chest compression no less than 18 sec
- 3) Defibrillation–16%. Recognizing shockable and non-shockable rhythm, dose of defibrillation
- 4) Chest Compression Fraction (CCF)–20% as marker of high-quality CPR–CCF should be 60–80%.

4.4 Ethics

The study was approved by Local Ethic Commitment of Kazakh National University of Continuous Education in Almaty, Kazakhstan on 20th of April 2018 (reference number 1/2018). The research was provided in accordance with main principals of medical research Helsinki Declaration, in respectful manner toward research' participants and with protection of their rights. All participants were informed verbally and by email about aims, objectives, and methods of study. Also, general principles of voluntary, anonymity, confidentiality, and privacy policy were explained and guaranteed. A consent form was taken and signed by each participant of study before research process had started. Moreover, all nurses who was attended and participated in study were informed that they are able to withdraw their consent any time and it will not influence their further career, reputation, or relationship with the employer.

All papers with results of ISS performance, ISS skills checklists, Self-evaluation questionnaire of the nurses' confidence, ALS-knowledge assessment MCQ written tests were kept in locked cabinet of the researcher's office. Also, electronic SPSS 25 database were stored on finger-print protected laptop. Moreover, the observers' role and their participation in research were

discussed and explained to nurses. It was clarified that gender, nationality, race, or social status does not affect the attitude of observer toward participants and on results of observation.

4.5 Statistical analysis of the data

In case of inductive statistic approach, the main aim of the researcher is to create hypothesis and correctly choose statistic criteria for testing it (Kochetov, Lyang, Massenko, Zhiron, Nakonechnikov, Tereshchenko, 2012, 14). So, for this research, an experimental study design was chosen, and a null hypothesis was created using study's research questions. Statistical hypotheses are applied in order to check for statistically meaningful distinctions between matching groups to evaluate the nature of the distribution of a trait in a statistical population. There are two statistical hypotheses due statistical analysis have been checked (Tsarik, 2012, 40; Freeman & Walters, 2015, 506).

Nelson, Dumville and Torgerson (2015) stated that when research question is ready, researcher can formulate the null (H_0) and alternative (H_1) hypothesis. Generally, statistical analysis relies on the supposition that a null hypothesis (H_0) is true until it is proven otherwise (ibid., 239). Also, the null hypothesis states that there are no differences among outcomes of several study groups. As far as null hypothesis is disproven, researcher is able to develop and check alternative hypothesis and prove difference between trial's groups outcome statistically. Both hypothesis testing processes use P-value extraction and revealed statistically significant difference due comparison data of study results (Freeman & Walters, 2015, 506).

Thus, for each confidence probability exists a proper level of statistical significance (P). The level of statistical significance expresses probability of null hypothesis (possibility the absence of difference between comparison study groups). The higher level of statistical significance shows the less difference between the groups. Therefore, statistical significance is a measure of confidence in the truth of the data analysis. For biostatistics and trial in medicine the confidence interval should be no less than 95%, either as P-value no more than 0,05 (Tsarik, 2012, 55; Freeman & Walters, 2015, 507, 509).

Generally, there are several levels of statistical significance:

$P \geq 0,1$ – there is evidence that null hypothesis is true;

$P \geq 0,05$ – there are both hypothesis doubtful neither null and alternative hypothesis;

$P < 0,05$ – null hypothesis can be rejected; In this research was used p-value $< 0,05$ as justification for rejection of null hypothesis.

$P \leq 0,01$ – null hypothesis can be rejected, strength evidence;

$P \leq 0,001$ – null hypothesis can be rejected, very strength evidence; (ibid., 56).

In order to test null hypothesis of quantitative independent samples for more than two groups (See figure 2) Kruskal-Wallis test were chosen (Kochetov et al., 2012, 14; Freeman & Walters, 2015, 513). When null hypothesis was rejected, researcher has started to test alternative hypothesis (See figure 2).

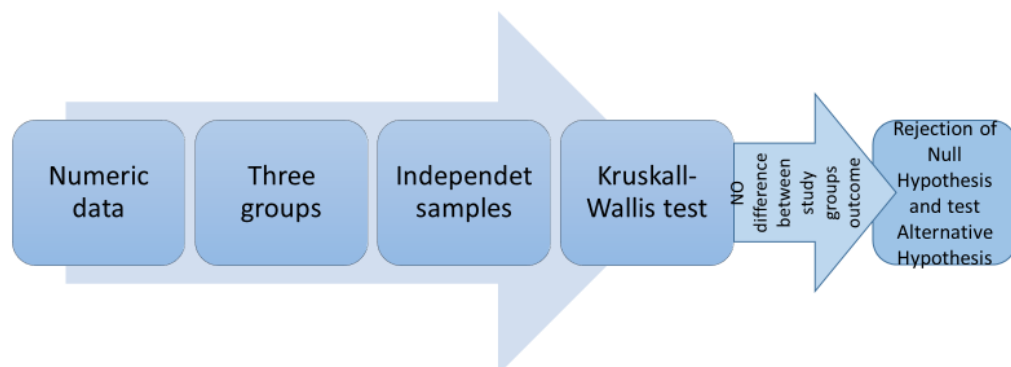


Figure 2. Methodology of inductive statistical processing of the study (adapted from Kochetov et al., 2012, 14)

It is needed to compare parametric and non-parametric data. In this study, quantitative data of three independent groups were compared with parametric and non-parametric tests (Grjibovski, Ivanov & Gorbatova, 2016a, 7) and descriptive statistics were performed with Statistical Package for the Social Sciences (SPSS) version 25.

In order to determine normality distribution of variables in small groups ($n=20$), the Shapiro-Wilk's W test was performed. This test is more significant and sensitive than Kolmogorov-Smirnov test, especially for a non-normal

distribution. In case if p-value is less than 0.05, distribution is considered as non-normal insofar as p value=1.0 is recognized as perfect normality (Peat & Barton, 2005, 34; Grjibovski, Ivanov & Gorbatova, 2016c, 12). In order to test the alternative theory and evaluate degree of difference between three groups through multiple comparisons the following were chosen: 1) Bonferroni criteria to compare three groups outcomes 2) Pearson's correlation coefficient pre-test, post-test, practical skills test (Kochetov et al., 2012, 18; Freeman & Walters, 2015, 519; Grjibovski et al., 2016a, 9).

4.6 Reliability and Validity

There are two basic criteria of quantitative research: validity and reliability. The validity of research is considered as how accurately the subject or phenomenon of study has been measured by the research instruments/tools. In order to prove validity of research instruments, Homogeneity, Convergence, and Theory evidence could be used (Heale & Twycross, 2015). In this research, the principle of homogeneity of instrument was applied. Three different tools were created in order to measure three variables: 1) Evaluation of ISS performance by ISS skills checklist, 2) Theoretical knowledge evaluation by ALS-knowledge assessment MCQ written test after each ISS scenario, and 3) Evaluation of nurses' confidence level by Likert-type self-evaluation questionnaire of nurses' confidence. Also, the predictive criterion of validity was used in order to explore how the level of a nurse's confidence can influence the ability to perform CPR and how ISS intervention can influence nurses' competence.

It is essential for a researcher to provide high standard of reliability in order to perform quantitative research successfully. Reliability is depended of tools and data collection instrument quality (ibid.209). The most popular method for testing reliability is the Cronbach's alpha which measures the internal consistency of the scales (Creswell, 2014, 217). If correlation coefficient Cronbach alpha is more than 0,7 it is considered as satisfactory and if 0,8 it is recognized as high desirable (Polgar & Thomas, 2013, 107; Polit & Back, 2012, 421). Cronbach's alpha was calculated for Self-evaluation questionnaire of the nurses' confidence, $\alpha = 0.865$. Thus, it meets requirements of questionnaire reliability.

Since in this research, the Self-evaluation questionnaire of nurses' confidence (See Appendix 4), ALS-knowledge assessment MCQ written test (See Appendix 2) and ISS skills checklist (See appendix 5) have been repeated during a three-month period, the test–retest reliability was more appropriate in order to archive consistency over time and understand whether test results would be the same every time or not. Reliability is expressed through Pearson's correlation coefficient in the range -1 to +1. If coefficient is more than +0,8 a reliability test is considered as an acceptable and recognized as a good test-re-test reliability (Polgar & Thomas, 2011, 107). There is one weakness could appear for the test–retest reliability; short time-interval between the tests could let participants to remember their answers. However, Curran et al., (2012) has already proven that skills and knowledge have deteriorated significantly in the period of two weeks; that is why the minimum pause between the interventions was designated as two weeks.

5 Results

5.1 Demographic distribution and background information of participants

As it shown in Table 2 (Demographic and nurses background characteristic in three groups), the mean age of participants was $36,07 \pm 10,379$ years; ranging from 19 till 57 years. Also, 57 nurses (95%) have graduated from medical colleges and 3 nurses (5%) were baccalaureates. The average duration of work in nursing practice among participants of study was $13 \pm 10,307$ years, n=3 (5%) have no any experience in nursing (post-graduate newcomer nurses), the other 57 participants had been working as nurses from 1 to 38 years. On the other hand, the mean experience of work on ICU or ED units was $7,7 \pm 7,4$ years, at least 7 nurses (11,7%) had been working in their units less than one year, the other 53 nurses had experience in their units from 1 to 33 years.

Regarding nurses' previous experience of participation in BLS and ACLS courses and simulation trainings, the following data were revealed: 36 nurses (60%) have attended in ACLS and BLS courses in past and 24 nurses (40%) have never had these trainings before. On the other hand, 32 nurses (53%) have experience of exercises with simulation, 28 nurses (47%) have never

participated in such events. Moreover, 42 (70%) respondents have reported that they have participated in IHCA less than one year ago, however 8 nurses (13%) have never been involved in CPR in their workplace (see Table 2).

Table 2. Demographic and nurses' background characteristics in three groups (N=60)

Criteria	Population (N=60)		
	Value	Number	Percentage
Age Group	20–25	12	20%
	26–30	10	17%
	31–35	8	13%
	36–40	10	17%
	41–45	7	12%
	46–50	6	10%
	51–55	5	8%
	56–60	2	3%
Medical Education	Incomplete Higher Education	1	2%
	Medical College	57	95%
	Medical Student	2	3%
Work Experience in Nursing	Less than 1 year	4	7%
	1–5	11	18%
	6–10	13	22%
	11–15	10	17%
	16–20	6	10%
	21–25	6	10%
	26–30	4	7%
	31–35	3	5%
	36–40	2	3%
	None	1	2%
Previous Experience in BLS / ACLS courses	Yes	36	60%
	None	24	40%
Work Experience in ED/ICU	Less than 1 year	7	12%
	1–5	22	37%
	6–10	19	32%

Most Recent Experience in IHCA	11–15	8	13%
	16–20	1	2%
	21–30	1	2%
	31–35	2	3%
	Less than 1 year	42	70%
	1-1,5 year	5	8%
	2 years	3	5%
	more than 3 years	1	2%
	more than 5 years	1	2%
Experience in Other Types of Simulations/Exercises	None	8	13%
	Simulations	6	10%
	Trainings	31	52%
Medical Qualification Certificate is Updated (every 5 years)	None	23	38%
	Yes	51	85%
	None	9	15%

5.2 Effect of in-situ simulation training intervention for confidence and competence of ICU and ED nurses

The normal distribution for each group (n=20) was tested with Shapiro-Wilk's W test and for group ALA A and ALA B the non-normal distribution was detected $W=0,543$ ($p=0,000$) and $W=0,773$ ($p=0,000$) respectively. On the other hand, AT group was close to normal distribution $W=0,948$ ($p=0,332$). In order to test alternative hypothesis, parametric analysis was done for normal distribution and non-parametric analysis for non-normal distribution.

5.2.1 ALS-knowledge assessment MCQ written test assessment of nurses' knowledge

As is shown in Table 3 of ALS-knowledge assessment MCQ written test results of three groups, all three groups were unable to achieve the test score requirement (at least 83%) during initial assessment of nurses' ALS knowledge (pre-test) by ALS-knowledge assessment MCQ written test and the mean score on groups ALA A, ALA B, and AT were 38,75%, 40,83%, and 65,83%

respectively. Third group had a better pre-test score and level of theoretical knowledge among nurses in Atyrau than nurses in Almaty groups. On the other hand, results of the ALS-knowledge assessment MCQ written post-test have demonstrated significant changes in the outcome between groups: the mean score on groups ALA A, ALA B, and AT were 81,66%, 62,5% and 80,83% respectively. However, after three months of intervention, the best positive dynamic was found in the first group 43% (Paired Samples T-test, $p=0,000$) and the medium dynamic was revealed in second group—22% improvement (Paired Samples T-test, $p=0,000$). The third group demonstrated only an improvement of 9% of the main score (Paired Samples T-test, $p=0,002$). It can be explained by the different frequency of interventions for each group, because each intervention included ALS-knowledge assessment MCQ written test and in-situ simulation practice with 20-minutes debriefing session as well. Also, theory was discussed during debriefing sessions after each intervention. Therefore, nurses from first group who were subjected to six interventions ($n=6$) have had more debriefing sessions than the second ($n=3$) and third ($n=2$) groups respectively. Thus, ALA A group had the opportunity to refresh their theoretical knowledge by frequent debriefing sessions and demonstrate the best test-score dynamic among the groups.

Table 3. ALS-knowledge assessment MCQ written test results for three groups of nurses

ALA A group (n=20)

Data collection tool	Pre-test*		Post-test	
	Mean score	Std. deviation	Mean score	Std. deviation
ALS-knowledge assessment MCQ written test results	38,75	14,37	81,66	4,35
Self-evaluation questionnaire of nurses' confidence	4,22	0.45	4,27	0.36
ISS skills checklist	52.43	23.13	96.5	7.02

ALA B group (n=20)				
Data collection tool	Pre-test*		Post-test	
	Mean score	Std. deviation	Mean score	Std. deviation
ALS-knowledge assessment MCQ written test results	40,83	13,21	62,5	15,17
Self-evaluation questionnaire of nurses' confidence	3.8	0.45	3,73	0.75
ISS skills checklist	54.18	25.53	82.57	20.25

AT group (n=20)				
Data collection tool	Pre-test*		Post-test	
	Mean score	Std. deviation	Mean score	Std. deviation
ALS-knowledge assessment MCQ written test results	65,83	17,91	80,83	13,27
Self-evaluation questionnaire of nurses' confidence	3,95	0,75	4,1	0,52
ISS skills checklist	58.41	22,77	72,15	17,91

*the first test for ISS checklist

5.2.2 Evaluation level of nurses confidence

Individual Self-evaluation Questionnaire of confidence (min score 1, max 5 point) demonstrated the following data (See Table 3). Despite the lowest level of ALS-knowledge assessment MCQ written pre-test main score in the first group, the highest level of the mean score of nurses' confidence was determined in the first group ALA A as 4.22, while in the second and third groups mean scores were 3,8 and 3,95 respectively. Nevertheless, post-test of nurses' confidence in each group did not reveal a statistically significant

difference with initial levels of confidence scores in these groups. So, the main score in first group ALA A has increased on 1,1% (Paired Samples T-test, $p=0.49$), while in third group AT was found improvement of the main score on 3% ($p=0,11$). However, in the second group ALA B, the main score of confidence decreased in the post-test by 1% ($p=0,46$).

5.2.3 Advanced Life support skills assessment results by ISS skills checklist

The best improvement of ISS skills score was revealed in the first group—44%, 28% and 14% in second and third groups respectively. The mean score 52,43% achieved by nurses in group ALA A after first session of ISS, which evaluated their CPR and ALS skills, demonstrated that only 15% managed to reach a minimum appropriate level of 83%. In the second group ALA B, the mean score after the first ISS intervention was 54,18%, and 20% of participants reached the threshold level. In the third group (AT), the mean score was 58,41%, and 20% of nurses passed ISS successfully (See Table 3).

The following results of the three groups were received in regard to the schedule of the ISS. In the first group ALA A the mean score was 96,5% after six interventions, and 90% of participants achieved the threshold level. There was significant improvement of the mean scores after six ISS interventions on 44% compared with the first one (Paired Samples T-test, $p=0,000$). Three ISS interventions were conducted for the group ALA B, and the following results were obtained: the mean score was increased from 54.18% to 82,57% (on 28,39%, $p=0,000$) and 65% participants of second group reached the minimum appropriate level of ALS skills after three interventions. The third group AT was exposed to two ISS interventions. The first main score of ISS skills checklist was 58,4% and increased to 72,15% (on 13,75%, $p=0.000$). Only 35% of participants successfully passed the simulation scenario after two interventions.

5.2.4 Relation between ISS intervention outcome and nurses' competence and confidence

Testing of null hypothesis was conducted. There was the assumption that the final level of nurses' confidence, ALS-knowledge assessment MCQ written

post-test score and results of final ISS skills checklists would be equal in three groups after different amounts of intervention. Firstly, distribution results of Self-evaluation questionnaires of the nurses' confidence level in groups ALA A, ALA B, and AT have been tested with the Kruskal-Wallis test and null hypothesis was rejected, the significance level being $\alpha=0,004$. Secondly, scores of ALS-knowledge assessment MCQ written post-test in each group was tested and the null hypothesis was rejected as well, the significance level being $\alpha=0,000$. Then the null hypothesis H_0 concerning absence of difference between results of the practical skill test after different number of ISS was checked with the Kruskal-Wallis test and rejected, the significance level being $\alpha =0,000$. Therefore, the null hypothesis was rejected, and alternative hypothesis was accepted.

The accepted alternative hypothesis stated that ISS intervention makes a difference between results of ALA A, ALA B, and AT groups in 1) results of Self-evaluation questionnaires of the nurses' confidence level, 2) ALS-knowledge assessment MCQ written post-test, and 3) ISS practical skills checklist results. In order to prove difference between three groups' outcome, Bonferroni criteria was applied (See Table 4).

Table 4. The difference of three groups' outcome by Bonferroni criteria

ALA A (n=20), ALA B (n=20), AT groups (n=20)

Data collection tool	Post-test	
	Pairwise comparison	Sig
ALS-knowledge assessment MCQ written test results	1 and 2 groups	0,000
	1 and 3 groups	1,000
	2 and 3 groups	0,006
Self-evaluation questionnaire of nurses' confidence	1 and 2 groups	0,004
	1 and 3 groups	0,121
	2 and 3 groups	0,141
ISS skills checklist	1 and 2 groups	0,050
	1 and 3 groups	0,000
	2 and 3 groups	0,322

Presented in Table 4, the most significant difference in ALS-knowledge assessment MCQ written tests outcome was determined between the first and second groups, $p=0,000$, and second and third groups, $p=0,006$, whereas difference between first and third groups results was not proven, $p=1.000$. It could be explained with the fact that ALA A group had a lower mean score in the ALS-knowledge assessment MCQ written pre-test results, which was 27,08% less than in third group AT. Nevertheless, group ALA A improved their outcome by 42,91% after six ISS-interventions with debriefings and could achieve mean score close to an appropriate level. On the other hand, AT group's outcome was close to an appropriate level as well, but an improvement of main score was only 9% in comparison with ALS-knowledge assessment MCQ written pre-test results.

As is presented in Table 4, the most significant difference in ISS skills checklist assessment outcome was determined between the first and third groups, $p=0,000$, and first and second groups, $p=0,05$. A difference between second and third groups results was not proven, $p=0,322$. This can be explained by the frequencies of ISS interventions. The number of ALA A group interventions was compared with number of AT and ALA B groups in order to compare its influence in the outcome (pass/fail ISS practical skills) by Fisher's exact test, and a statistically significant difference was found, $p=0,000$ (See Figure 3) and $p=0,000$ (See Figure 4) respectively. Also, the number of ALA B group ISS intervention was compared with the number of AT group ISS interventions in order to compare its influence in the outcome (practical skills) by Fisher's exact test, and a statistically significant difference was not found, $p=0,111$ (See Figure 5).

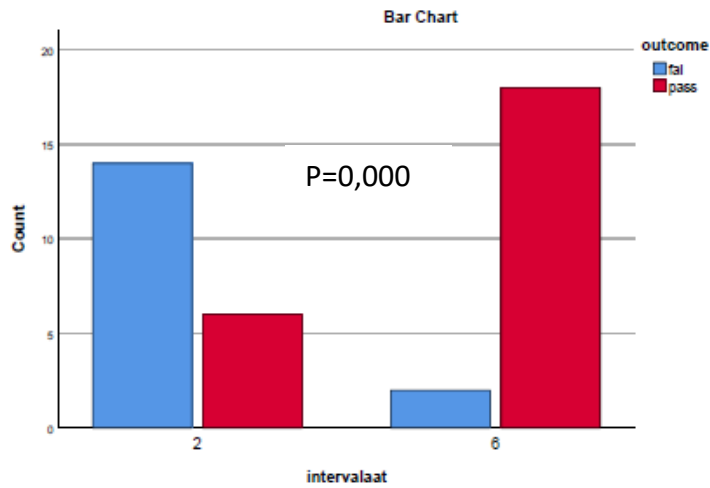


Figure 3. Relation of ISS practical skills test pass/fail outcome after ISS interventions in groups ALA A and AT

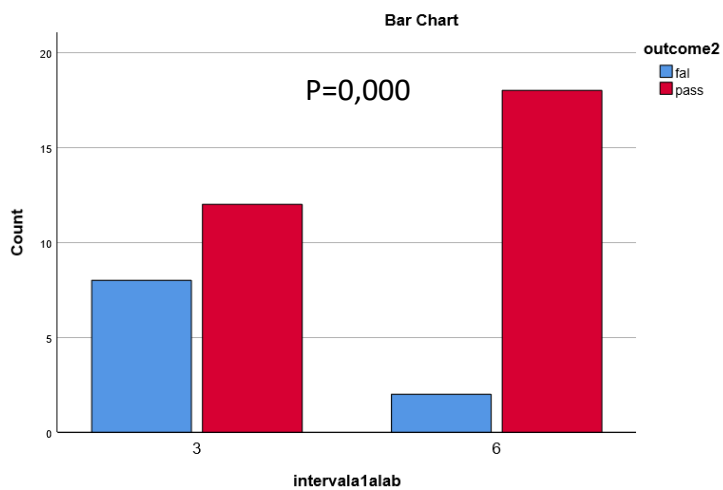


Figure 4. Relation of ISS practical skills test pass/fail outcome after ISS interventions in groups ALA A and ALA B

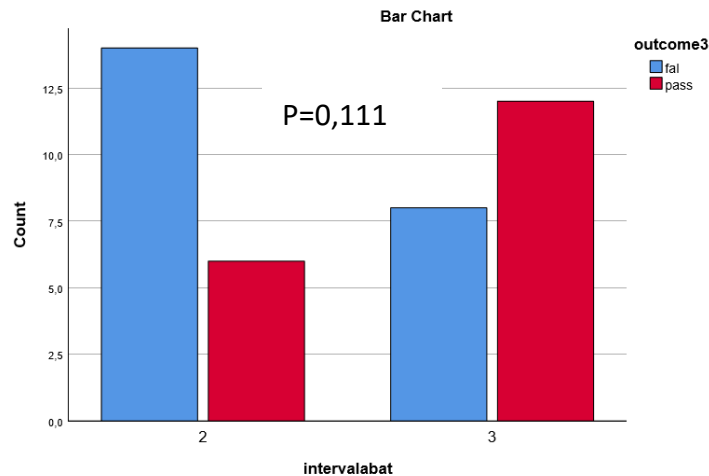


Figure 5. Relation of ISS practical skills test pass/fail outcome after ISS interventions in groups ALA B and AT

There was no statistically significant difference found between ALA A and AT mean score of the Self-evaluation questionnaire of nurses' confidence outcome, which was the same between ALA B and AT as well. Also, regarding Table 4 data, a statistically significant difference of $p=0,004$ was observed between ALA A and ALA B mean scores of the Self-evaluation questionnaire of nurses' confidence outcome. It could be explained by the negative dynamic of nurses' confidence level in ALA B group. Moreover, as a step in the research, level of relation between level of nurses' confidence outcome and each point of the Self-evaluation questionnaire of the nurses' confidence have been determined to clear-up which of the seven criteria is most significant to establishing confidence (See Table 5). So, regarding analysis of Self-evaluation questionnaire of the nurses' confidence outcome in each group the maximum mean scores in third (Q3) mean score=4,4 and fourth (Q4) mean=4,1 questions were revealed in ALA A group, second (Q2) mean=3,9 and seventh (Q7) mean=3,55 questions for ALA B group and fifth (Q5)=3,85 and sixth (Q6)=3,52 questions for AT group. The Pearson correlation test and Spearman's coefficient were performed by using SPSS-25 for this purpose. The result of Pearson correlation coefficient r in group AT was interpreted using Chaddock's table. Analysis of the correlation between the fifth question of Self-evaluation questionnaire of the nurses' confidence and CPR skills (See Table 5)

demonstrates a mild value of Pearson correlation test in AT group for Q5 $rs=0,684$, $p=0,001$ (See Figure 6, 7); in group ALA-B–for Q2 $rs=0,765$ (high relation, $p=0,000$) (See Figure 8, 9) and in ALA-A group–for Q4 is Spearman’s ρ $rs=0,806$ (high relation, $p=0,000$), respectively (See Figure 10, 11).

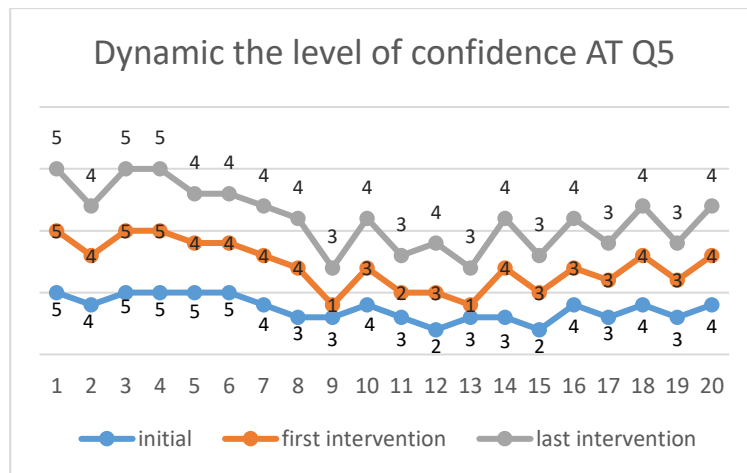


Figure 6. Dynamic level of nurses’ confidence in group AT regarding question 5 of self-evaluation questionnaire of nurses’ confidence

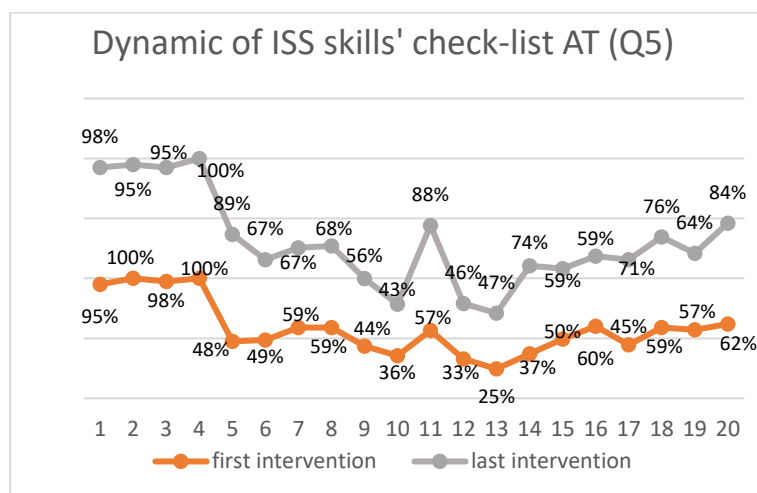


Figure 7. Dynamic mean score of ISS skills’ checklists in group AT

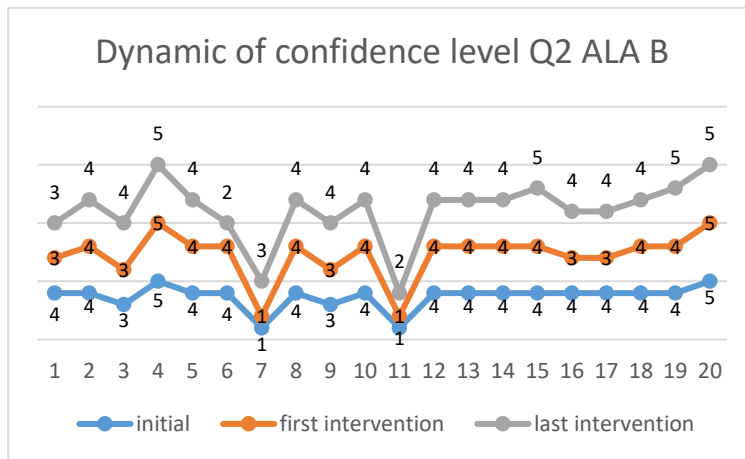


Figure 8. Dynamic level of nurses' confidence ALA B group regarding question 2 of self-evaluation questionnaire of nurses' confidence

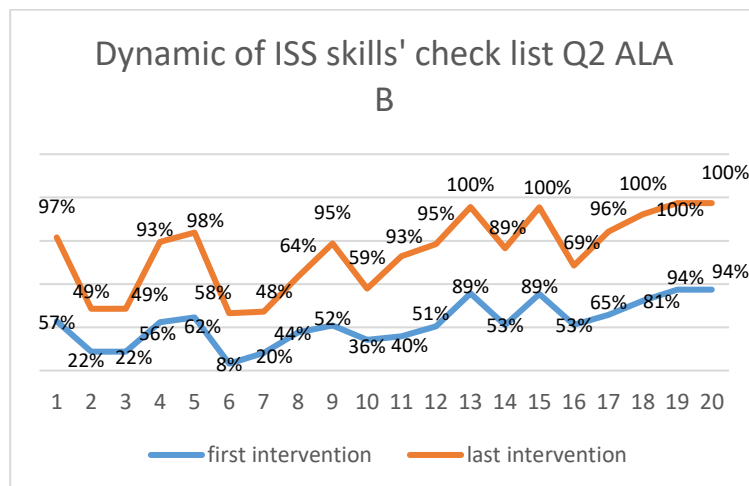


Figure 9. Dynamic mean score of ISS skills checklists in group AT

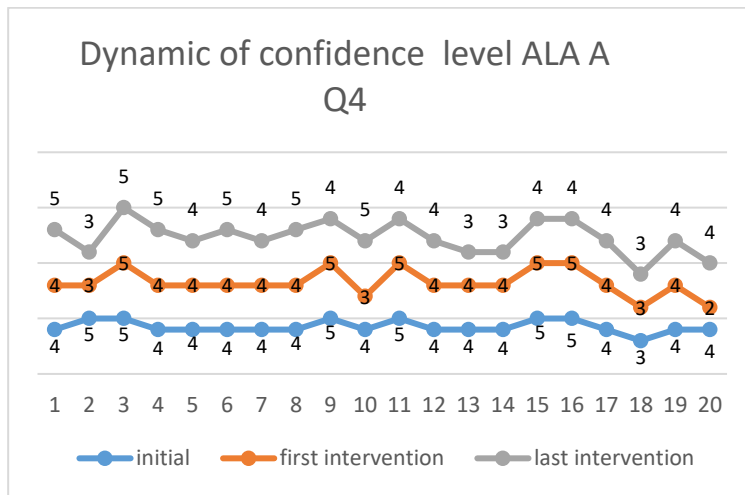


Figure 10. Dynamic level of nurses' confidence in group ALA A regarding question 4 of self-evaluation questionnaire of nurses' confidence

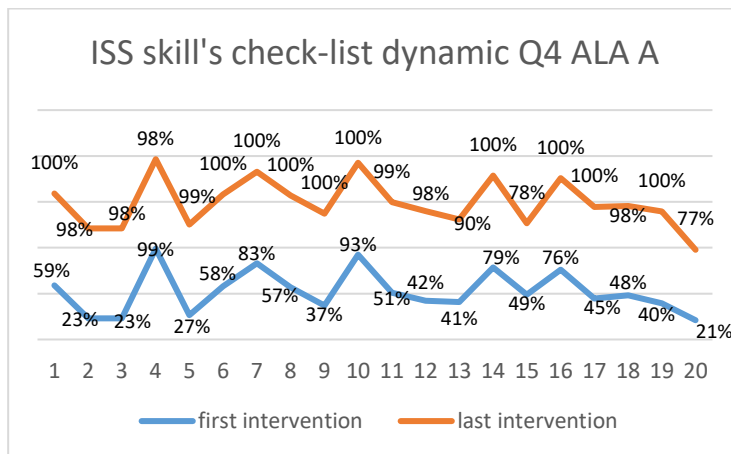


Figure 11. Dynamic mean score of ISS skills checklists in group ALA A

The diagrams show that confidence level grows from initial to outcome assessment which is confirmed by the results of ISS skills checklist after the first and last interventions. In addition, a positive dynamic of both confidence and skills level is clearly shown. Moreover, for group AT was determined a high relation between confidence levels outcome after two ISS interventions and initial level of nurses' confidence $r^2 = 0.7925$; medium relation between confidence level outcome after two ISS interventions and ALS skills assessment outcome by ISS skills checklist $r^2 = 0.423$; weak relation between nurses confidence level outcome with ALS-knowledge assessment MCQ

written post-test results $r^2 = 0.09$. Self-evaluation questionnaire of the nurses' confidence outcome in group AT after second ISS intervention demonstrated that self-confidence is more related to practical skills rather than theoretical knowledge.

Table 5. Determining correlation between points of Self-evaluation questionnaire of nurses' confidence and CPR skills

No	Question	Group name	Correlation
1	I am sure that I know correct place of my hands on the patient's chest for performing the chest compressions		
2	I am confident that I can participate in CPR	ALA B	Spearman's rho 0,765 (p=0,000)
3	I am confident that I can be useful for resuscitation team	ALA A	Spearman's rho 0,676 (0,001)
4	I am sure that I know how to recognize a cardiac arrest in a patient	ALA A	Spearman's rho 0,806 (p=0,000)
5	I am confident that I can initiate CPR by myself	AT	Pearson correlation 0,715 (p=0,000)
6	I am confident that I know whole algorithm of CPR	AT	Pearson correlation 0,885 (p=0,000)
7	I am confident that I can do whole algorithm of CPR correctly	ALA B	Spearman's rho 0,827 (p=0,000)

Since this research has focused on the exploration of the ability nurses to perform CPR, relation between the average level of nurses' confidence, and two important points of Self-evaluation questionnaires of nurses' confidence (recognition of cardiac arrest and ability to initiate CPR by themselves), each group was tested by Pearson and Spearman's rho correlations (See Table 6).

Table 6. Relation between average level of nurses' confidence and ability to recognize cardiac arrest and initiate CPR

AT Group, Pearson correlation		
Criteria	Pre-test	Post-test
recognition of cardiac arrest	0,860 (p=0,000)	0,814 (p=0,000)
ability to initiate CPR by themselves	0,915 (p=0,000)	0,715 (p=0,000)
ALA A Group, Spearman's rho		
recognition of cardiac arrest	0,505 (p=0,023*) *correlation is significant at the 0,05 level	0,806 (p=0,000)
ability to initiate CPR by themselves	0,696 (p=0,001*) *correlation is significant at the 0,01 level	0,507 (p=0,023*) *correlation is significant at the 0,05 level
ALA B Group, Spearman's rho		
recognition of cardiac arrest	0,622 (p=0,003)	0,650 (p=0,002)
ability to initiate CPR by themselves	0,492 (p=0,027*) *correlation is significant at the 0,05 level	0,650 (p=0,002)

The high relation between the outcome of confidence levels and recognition of cardiac arrest was revealed in groups AT and ALA A (See Table 6). Concerning confidence in being able to initiate CPR and the average level of nurses' confidence in the groups, a high relation was revealed in group AT whereas in ALA A and ALA B a medium relation was found. Nevertheless, there was a decrease in the relation in group AT in both points from 0,860 to 0,814 (recognition of CA) and from 0,915 to 0,715 (ability to initiate CPR), respectively. In addition, in group ALA A, a decreasing of relation between average level of confidence and ability to initiate CPR from 0,696 to 0,507 was found. At the same time, an improvement of the relation in both points was found in group ALAB. However, all changes were identified within the same rank.

6 Discussion

The purpose of this study was to explore nurses' knowledge and skills on advanced life support in ICU and ED in order to determine how in-situ simulation training intervention will influence nurses' confidence and ability to perform CPR. There were three groups of ED and ICU nurses that were randomly divided with twenty nurses ($n=20$) in each group. After a preparation period, which included the traditional ALS training course for ICU and ED nurses, evaluation of their ALS knowledge by written MCQ pre-test and determining the initial level of nurses' confidence by a Self-evaluation questionnaire, the following frequency of intervention was applied: 1) the first group was exposed to six ISS interventions with a 20-minute debriefing session every two weeks, 2) the second group was exposed to three ISS interventions with a 20-minute debriefing session every month, 3) the third group was exposed to two ISS interventions with a 20-minute debriefing session immediately after ALS training and three months after ALS training. Six ALS scenarios were created for each intervention, and all ISS intervention sessions were evaluated by ISS skills checklist.

6.1 Discussion of In-situ simulation findings on nurses' competence

The first aim of research was to study the effect of in-situ simulation training intervention on ICU/ED nurses' competency in their ability to perform CPR. For this research, an experimental study design was chosen and a null hypothesis generated concerning the absence of a difference between the outcome of three groups after different number of ISS interventions. Since the aim was to study nurses' competency, evaluation of ALS practical skills and ALS knowledge was performed. In order to test null hypothesis, a Kruskal-Wallis test was applied. Null hypothesis was rejected for both variables: ALS-knowledge assessment MCQ written post-test in each group, the significance level $\alpha=0,000$ and ISS practical skill' test, the significance level $\alpha =0,000$. So, alternative hypothesis was tested. Thus, as was expected, the best improvement of ISS skill score was revealed in the first group. The mean score 52,43% after the first ISS intervention increased significantly, 44% after six

ISS interventions and reached the mean score 96,5% (Paired Samples T-test, $p=0,000$). For second group ALA B, three ISS interventions were conducted, and following results were obtained: the mean score increased from 54,18% till 82,57% (on 28,39%, $p=0,000$). The third group AT was exposed to two ISS interventions. The first main score of ISS skills checklist was 58,4% and increased till 72,15% (on 13,75%, $p=0,000$). Thereby, research results could confirm the previous statement that ISS trainings did increase the level of competence and practical skills (Huseman, 2012; Delac et al., 2013; Smith & Andersen, 2014; Reece et al., 2016).

After three months of interventions, the best positive dynamic concerning ALS-knowledge assessment MCQ written test results was found in the first group, 43% (Paired Samples T-test, $p=0,000$), and a mild dynamic was revealed in the second group with a 22% improvement (Paired Samples T-test, $p=0,000$). Unfortunately, the third group demonstrated only a 9% improvement of the main score (Paired Samples T-test, $p=0,002$). The lack of positive dynamic in the third group could be explained by statement of Curran et al., (2012) that nurses' achievements in CPR received during training course are reduced already after two weeks after end of class. So, there was no meaningful positive dynamic in the third group because there were only two debriefing sessions with discussion of ALS theory, and the session interval was three months. On the other hand, ISS intervention with a debriefing session and a brief discussion of ALS theory every two weeks has not let nurses' ALS knowledge deteriorate, instead contributing to the retention of ALS knowledge and even their improvement. Thus, group ALA A had a good opportunity to refresh their theoretical knowledge during debriefing sessions ($n=6$) and demonstrated the best test-score dynamic among the three groups.

What was unexpected for the researcher? Despite the fact that 36 nurses (60%) had attended ACLS and BLS courses in the past, 32 nurses (53%) had experience of exercise with simulation, and 42 (70%) respondents had participated in IHCA less than one year ago, the mean score after the first session of ISS was only 52,43% in first group ALA A, 54,18% in group ALA B, and 58,41% in group AT. Unfortunately, there were only 15% nurses who demonstrated a minimum appropriate level of 83% on their CPR and ALS skills in group ALA A whereas in the second group ALA B, 20% of participants

could achieve the threshold level. In the third group AT, 20% nurses could pass ISS scenario successfully. Moreover, the results were the same with ALS-knowledge assessment MCQ written test results of three groups of nurses. Sadly, all three groups failed to achieve the test score requirement (at least 83%) during initial assessment of nurses ALS knowledge (pre-test) by ALS-knowledge assessment MCQ written test. Despite the fact that ALS-knowledge assessment MCQ written post-test demonstrated significant changes in the outcome between groups: the mean score on groups ALA A, ALA B, and AT was 81,66%, 62,5% and 80,83%, respectively. So, none of the groups could reach the test score requirement—at least 83%. This meets with study results of Rajeswaran & Ehlers (2014) which reported about the lack of initial competence: no nurse passed the writing pre-test during research, moreover, post-test was conducted three months later and revealed degradation of knowledge. The lack of initial competence of nurses (knowledge and practical skills) could be explained by the absence the principles of continuous education and self-improvement among nurses and experience as well: 24 nurses (40%) had never had ACLS and BLS training before, 28 nurses (47%) had never participated in simulation scenarios or exercises, and 8 nurses (13%) had never been involved in CPR in their work place. Also, there was no appropriate requirement for BLS and ACLS certification every two years. Moreover, ISS mock code was not implemented in medical facilities and was available in simulation training center only. Thus, nurses have not had the opportunity of permanent CPR and ALS simulation training in their workplace in order to keep their competence on the appropriate level.

6.2 Discussion of In-situ simulation findings on nurses level of confidence

The second aim was to determine the level of confidence to start CPR among ICU/ED nurses after in-situ simulation training intervention. The Self-evaluation questionnaire of nurses' confidence based on Likert-type scale (Wade, 2006) with seven statements regarding nurses perception of their ability to participate in CPR, being useful during IHCA, awareness of CPR technique, ability to initiate CPR and range of agreement from 1 to 5 (min score 1, max 5 point) was applied in order to determine level of nurses'

confidence. Each nurse was provided with a self-assessment tool several times: before the first intervention and then after each intervention for a three-month period. Researcher's expectation was that level of nurses' confidence would significantly increase after ISS intervention and debriefing considering previous studies (Curran et al., 2012; Delac et al., 2013; Herbes & Heaser, 2016). However, post-test of nurses' confidence in each group did not reveal statistically significant differences with initial levels of confidence scores in three groups. Also, according to Curran et al., (2012) confidence could be increased through an actual discussion session (debriefing) with participants of resuscitation. So, the main score in the first group ALA A (number of ISS interventions with debriefing, n=6) was increased by 1,1% (Paired Samples T-test, $p=0,49$), while in the third group AT, the main score was raised by 3% ($p=0,11$). Nevertheless, in the second group ALA B, the main score of confidence decreased during the post-test by 1% ($p=0,46$). The second group had the lowest initial level (3,8) of nurses' confidence among three groups, so, it could be expected that initial level of confidence would influence the outcome. Also, the low level of initial confidence and negative dynamic of the outcome could be explained with low self-esteem among nurses of group ALA B. It was proven by a previous study by Reece et al., (2016) that there were 5,1% of study participants who reported about less confidence after mock code. Nonetheless, it should be studied deeper in future research. One more assumption is that the completed Self-evaluation questionnaires of some nurses' confidence were not accurate or attentive. One more observation is that after ISS intervention, nurses recognized the real level of their competence which did not meet the appropriate level, so they scored less than on previous time.

However, if each point of the Self-evaluation questionnaire of the nurses' confidence were considered separately, the mean score of nurses' confidence was calculated for each point of the questionnaire and compared in order to find correlation between mean level of group confidence and each from seven points, more interesting results have appeared. Thus the maximum mean scores of the nurses' confidence outcome in group ALA A were in third (Q3) mean score=4,4 and fourth (Q4) mean=4,1 questions, second (Q2) mean=3,9 and seventh (Q7) mean=3,55 questions for group ALA B and fifth (Q5)=3,85 and sixth (Q6)=3,52 questions for group AT. The highest relation was

determined in group ALA-A – for Q4 is Spearman's rho $r_s=0,806$ (high relation, $p=0,000$) and in group ALA-B – for Q2 $r_s=0,765$ (high relation, $p=0,000$) recognition of CA and ability to participate in CPR, respectively. Nevertheless, the medium relation between confidence level outcome after two ISS interventions and ALS skills assessment results by ISS skills checklist was found in AT group $r^2 = 0.423$; weak relation between nurses' confidence level outcome with ALS-knowledge assessment MCQ written post-test results $r^2 = 0.09$. This concurs with the statement of Reece et al., (2016) that correlation between Code Component Self-Confidence results and mock code evaluation scores have a statistically significant relationship ($r=0.28$, $p=0.035$).

Also, two main points of the Self-evaluation questionnaire of nurses' confidence and ISS skills checklist were tested in order to determine relation between ALS practical skills and level of nurses' confidence. The high relation between confidence levels outcome and recognition of cardiac arrest was revealed in AT and ALA A groups ($r_s=0,814$ ($p=0,000$) and $r_{ho}=0,806$ ($p=0,000$)). Concerning confidence to being able to initiate CPR, a high relation was revealed in group AT, whereas in ALA A and ALA B a medium relation was founded. However, it was surprising that some changes were identified: a decreased relationship for one of the important points, but all fluctuation was within the same rank. For example, in group ALA A was revealed decreasing of relation between average level of confidence and ability to initiate CPR.

6.3 Implication for nurses of Kazakhstan

Despite the low level of ALS-knowledge assessment MCQ written pre- and post-test and ALS practical skills in three groups, there was a positive dynamic revealed. So, nurses in Kazakhstan have had a potential for further improvement and learning, enhancing their knowledge through continuous education. Thus, improvement of nurses' competence may influence the quality of CPR, return patients to normal heart rhythm after IHCA, and improve patient outcomes (Girotra et al., 2012; Rajeswaran & Ehlers, 2014). Also, it was not enough to have a refresh course every five years, regarding "The Rules for the certification of health professionals" of RoK standards. Moreover, insufficiency of two or even a one-year period has been proven as

well (Allen et al., 2012; Bhanji et al., 2015). Eight per cent of respondents have never been involved in IHCA and 47% have never attended ISS training, so it had a negative impact on nurses' emergency response preparedness, and according Huseman (2012) and Curren et al., (2012) traditional education classes cannot resolve the problem of lack of competence, and they have not granted brilliant CPR performance during real emergency. So, implementation of ISS in the workplace can resolve problems mentioned above.

7 Conclusion

ISS intervention is one of modern methods of education for HCWs and especially for ED and ICU staff. As nurses in ED and ICU are the first line of emergency response in case of any life-threatening conditions, they should keep their competence and confidence on the appropriate level. ISS intervention in the workplace significantly improves nurses' competence in ALS and CPR, especially ALS practical skills, and directly depends on frequency of ISS interventions. Thus, ISS in the workplace, in combination with debriefing, were able to increase nurses' CPR mechanical skills through theoretical knowledge regarding the debriefing part of ISS intervention. The most significant changes in nurses' knowledge and skills have been determined after conducting interventions every two weeks. ISS intervention did not influence the total average level of nurses' confidence but was able to increase nurses' confidence in specific CPR issues: ability to recognize CA, ability to initiate CPR by them, and confidence that the nurse could participate in CPR and be useful for the CPR-team. The level of nurses' confidence had a high relationship with appropriate level of nurses ALS and CPR practical skills and weak relation with nurses' theoretical ALS knowledge. Outcome and an improvement in the level of nurses' confidence depend on the initial level of nurses' confidence before ISS intervention.

8 Recommendation

It is recommended to implement In-situ simulation mock code in all major clinical hospitals in Kazakhstan in collaboration with Departments of Medical University and High Medical Colleges as a pilot project for implementing ISS

in workplaces for Emergency Department and Intensive Care Unit. It will help to ensure necessary equipment (a high-fidelity mannequin), and BLS and ACLS instructors and facilitators for the primary stage. During the next stage, it is recommended that in order to enhance nurses' leadership and interdisciplinary skills, potential coaches among the nurses should be selected who would further conduct ACLS and BLS trainings on a regular basis and ISS in the workplace for HCWs. The schedule of ISS mock code in a medical facility is required through an individual discussion with hospital authorities optimally biweekly in accordance to principles of continuous education.

For further research, the following points are recommended. In order to evaluate the level of nurses' confidence, the initial low self-esteem among nurses should be considered as one of the influencing factors. So, the hospital grief counselor could be involved in evaluation of confidence and in improving the Self-evaluation questionnaire of nurses' confidence. Also, the possibility to consider a face-to-face interview is recommended for the deeper evaluation of nurses' confidence level.

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Appendices

Appendix 1. ALS-knowledge assessment MCQ written test

1. What is most appropriate time for pulse checking according to BLS algorithm?

- A. 1 to 5 seconds
- B. 5 to 10 seconds**
- C. 10 to 15 seconds
- D. 15 to 20 seconds

2. What is most appropriate dosage of aspirin recommended for per-oral use for patients with suspected ACS?

- A. 2-4 mg
- B. 80-120 mg
- C. 160-325 mg**
- D. 400-600 mg

3. What is most effective technique of airway opening?

- A. Instrumental fixation of tongue
- B. Hit tilt and chin lift**
- C. Heimlich maneuver
- D. Use of a mask with rebreather

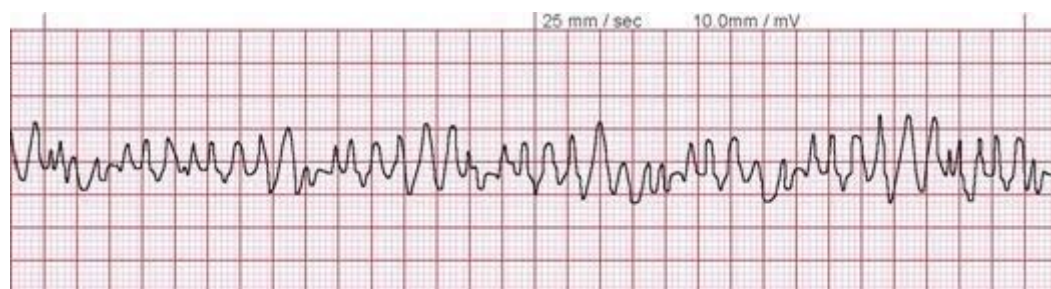
4. What improves quality of chest compressions at CPR?

- A. Observing of cardiac rhythm on monitor
- B. Ensuring of partial chest recoil after each compression
- C. Compressions of upper half of chest 90-100 per minutes
- D. Swopping of rescuers delivering compressions and ventilations at tiring**

5. What is appropriate ventilation rate in patient with advanced airway in place?

- A. 6 / minute
- B. 8 / minute
- C. 10 / minute**
- D. 14 / minute

6. An unresponsive victim has been delivered to the ED. At initial assessment you have found out that there is no carotid pulse and breathing. You have started effective CPR (30:2) and analyzed cardiac rhythm. You can observe the next on the monitor:



What is your next action?

- A. Amiodarone 300mg IV

- B. Adrenaline 1 mg IV
- C. Defibrillation**
- D. Check for carotid pulse

7. An unresponsive victim has been delivered to the ED. At initial assessment you have found out that there is no carotid pulse and breathing. You have started effective CPR (30:2) and analyzed cardiac rhythm. You can observe the next on the monitor:



What is your next action?

- A. Resume chest compressions immediately**
- B. Amiodarone 300mg IV
- C. Deliver shock 200 J
- D. Check for carotid pulse

8. What of the following is indication for cessation of resuscitation attempt?

- A. Missing of patient's relatives
- B. Unsafe environment for rescue team**
- C. Patient's age over than 88 years
- D. Missing of spontaneous circulation after 10 minutes of CPR

9. What is initial dosage of Heparin for stroke patients in pre-hospital setting?

- A. 2500 ME
- B. 5000 ME
- C. 10000 ME
- D. Heparin is contraindicated**

10. A 58 years old man complaints on chest pain irradiating to his left arm. Patient's reaction is retarded, respiratory distress. BP is 140/80 mmHg, pulse rate 105/minute, respiratory rate is 23/minute, SaO₂ is 96%. 12-lead ECG shows elevation of ST-segment in anterior leads. Emergency Medical Team has given him 160 mg of aspirin and established IV access. At the moment patient is in ED. Patient describes his pain as 7 of 10 and that has not revealed after three doses of Nitromint spray. What is most appropriate next action?

- A. Additional dose of aspirin 350 mg
- B. Infusion of Nitroglycerin 10 mg IV

- C. Oxygen with mask 15L/min
- D. Morphine 2-4 mg IV slowly**

11. You have found a 40-years old unresponsive male on his bed at morning round. Patient has no breathing and carotid pulse. What technique is most appropriate for airway protection?

- A. Nasopharyngeal tube insertion
- B. Laryngeal mask use
- C. Hit tilt chin lift**
- D. Instrumental fixation of the tongue

12. What is most appropriate action following defibrillation?

- A. Ensure airway potency
- B. Check for carotid pulse
- C. Check ECG for rhythm
- D. Resume CPR starting from chest compressions**

Appendix 2. Simulation scenario templates

Simulation Scenario Template 1

Scenario Title: and environment:	Basic Airway Management and Bag-Mask Ventilation Emergency Department (ED)	
Study unit/target group:	Registered nurses of Emergency Department (ED)	
Learning outcomes (knowledge, skills, attitudes/behaviors):	Technical skills:	Non-technical skills:
	Demonstrate appropriate bag-mask ventilation technique on the mannequin	Able to report symptoms of respiratory arrest
	Demonstrate manual maneuver (head-tilt chin-lift) on the mannequin	Able to explain at questioning how to detect proper size of oropharyngeal and nasopharyngeal airway
	Demonstrate basic adjuncts to airway management (insertion of oropharyngeal and nasopharyngeal airway) on the mannequin	Able to explain at questioning the indications to start bag-mask ventilation;
	Demonstrate manual clearing (aspiration) of patient's airway on the mannequin	Able to explain at questioning the indications and the contraindications to oropharyngeal and nasopharyngeal airway insertion
Participants and roles:	<ul style="list-style-type: none"> - Simulation patient – mannequin - Registered nurse of ED – assessed - Assistant – a nurse from the group 	
Scenario Description		
(I) Identification of the patient and location information (name, age etc.)	Patient with in-hospital respiratory arrest. Mannequin "Resusci Anne" by Laerdal.	
(S) Current situation (immediate clinical situation, particular issues, concerns or risks)	<p>Newly admitted patient, 56 years old female with respiratory arrest due to possible STROKE.</p> <p>Emergency Medical Service (EMS) team delivering a patient with suspicion on stroke to your Emergency Department. You are dispatched to provide primary survey of her. The patient has lost consciousness just before arrival to ED.</p>	
(B) Background information (relevant clinical history diagnosis, medications, allergies etc.)	<p>S – The FAST has been evaluated by EMS-team on-scene: F-face asymmetry (left side) A- left arm drift S- she was unable to speak well, slurred words T – The symptoms of possible Stroke have been mentioned 2 hours ago before the present time</p> <p>A - No</p> <p>M – Atenolol 50 mg daily in morning time</p> <p>P – She suffers from essential hypertension for last ten years</p> <p>L –She had breakfast 5 hours before the present time</p> <p>E – She has got an emotional stress and have not taken hypotensive medication for a while EMS team informs you that she was snoring and gargling during all transportation period from her home to ED, she is</p>	

	“getting worse”, oxygen saturation has decreased from 97 to 87% (room air) for that time. Request for immediate assessment and nurse intervention. Notes and clinical information will be gathered for your arrival.							
(A) Assessment of the situation and observations	Further information (if requested)							
(R) Recommendations for the professionals/shift, further assessments and actions Required, expected frequency of observations etc.)	Manual maneuver for opening airway does not work, BOOTS (obesity and snoring) – patient is over-weighted (BMI 36).							
Simulator Setup								
Airway		Breathing		Circulation		Disability		Exposure
Airway Sounds	Snoring and gargling	Respiratory Rate, breath/min	6	NIBP, mmHg	180/120	CGS	8	No any injury or major external bleeding
	No a foreign body found in the mouth	Respiratory Pattern		Pulse Rate, per min	62	AVPU	<u>P-</u> <u>ain</u>	
	Airway is blocked by patient’s tongue and mucus	Chest rise	+	ECG	No significant changes			
		Breathing sounds	crackles	Body temperature	36.8			
		SpO₂	87%					
Other relevant information								
n/a								
Scenario progression		Effective management			Lifesaver			
Initial Assessment		ABCDE approach			Rapid visual inspection of oral cavity			
					Checking for breathing			
					Call for help (resuscitation team)			
		Open airway			Head-tilt chin-lift			
		Aspiration			Insertion of aspiration catheter into the oral cavity and suction within 15-30 sec			
Assisted Ventilation		Bag-valve mask ventilation: 1 breath in every 6 seconds FiO ₂ 85%			applying face-mask using the C-E method and delivering of 12 breaths in 1 min by BVM			
		Monitor SpO ₂			Check whether SpO ₂ is not less than 94% oxygen flow 10 L/min			
		Assess efficiency of ventilation			Check for chest elevation at each ventilation, effort for squeezing bag, auscultation of lungs			
Consideration of Indications for Basic Airway Adjuncts if BVM is Ineffective		BOOTS (beard-obesity-old-teeth-snoring)			Obesity + snoring			
		Determine the indications for basic airway adjuncts			Patient is unresponsive – indication for oropharyngeal airway			

Basic Airway Management	Choose proper size of oropharyngeal airway	Determine proper size of OPA measuring distance between mouth angle and earlobe
	Insert OPA	Apply water-soluble lubricant onto OPA, insert it into airway in inverted manner
	Evaluate efficiency of ventilation	Check for chest elevation at each ventilation, effort for squeezing bag, auscultation of lungs, re-check SpO ₂
Criteria for closing the scenario: resuscitation team has arrived to the scene or SpO ₂ has increased up to 96%		
<p>Notes: handover and transfer to ICU Discussions after completing simulation:</p> <ol style="list-style-type: none"> 1) Importance of obtaining of relevant background information 2) Ventilation strategy at obese patient with unprotected airway 3) Partial airway obstruction 4) Appropriate escalation and call for help 5) TEAM-tool feedback 6) Airway management key points 		

Simulation scenario template 2

Scenario Title: and environment:	In-hospital cardiac arrest	
Study unit/target group:	Nurses of Emergency and Intensive Care Unite departments (ED and ICU)	
Learning outcomes (knowledge, skills, attitudes/behaviors):	Technical skills:	Non-technical skills:
	Correct chest compression technique (depth, hands placement, ratio, frequency)	Ability to recognize cardiac arrest
	Correct mouth-to-mouth ventilation technique	Ability to initiate Cardio-pulmonary resuscitation (CPR)
	Correct time for checking pulse and breathing (5-10sec)	Confidence behavior due emergency situation
		Effective team dynamic (chest compression fraction (CCF) – 60-80%)
Participants and roles:	Simulation patient – mannequin Resuscitation team – 5 nurses and one guest, who performs doctor’s role Registered nurse of ED or ICU – assessed person Assistant – 4 nurses from the group and one guest	
Scenario Description		
(I) Identification of the patient and location information (name, age etc.)	Patient Mrs. J, Female, 64 y.o. arrived at ED 10 minutes ago. Mannequin “Resusci Anne” by Laerdal. Newly admitted patient, 64 years old female with short breathing and acute chest-pain, cardiac arrest due to possible Acute coronary syndrome (ACS).	
(S) Current situation (immediate clinical situation, particular issues, concerns or risks)	Emergency Medical Service (EMS) team delivering a patient with suspicion on ACS to your Emergency Department. You are dispatched to provide primary survey of her. The patient has just suddenly collapsed in front of you and currently is lying on her left side on the floor. The Scene is safe.	
(B) Background information (relevant clinical history diagnosis, medications, allergies etc.)	S – The ACS has been evaluated by EMS-team on-scene, ECG is done: STEMI (II, AVL, V1-3), troponin test - positive. The symptoms of possible ACS have been mentioned 1 hours ago before the present time A - No M – Captopril 25 mg daily in morning time P – She suffers from essential hypertension for last five years L – She had breakfast 3 hours before the present time E – no any significant events	
(B) Assessment of the situation and observations	EMS team informs you that they gave to her primary care according, but she is “getting worse”, Blood pressure has decreased from 150/100 to 90/50mmHg for that time after administration 100mg of Tramadolium and 2 dose of Nitromint spray.	

(R) Recommendations for the professionals/shift, further assessments and actions Required, expected frequency of observations etc.)				Request for immediate assessment and nurse intervention. Notes and clinical information will be gathered for your arrival. Further information (if requested) Scene is safe, nobody start CPR or call for help				
Simulator Setup								
Airway		Breathing		Circulation		Disability		Exposure
Airway Sounds	gaspings	Respiratory Rate, breath/min	absence	NIBP, mmHg	0	CGS	-	Cyanosis, skin is wet, diaphoresis, cold
		Respiratory Pattern	absence	Pulse Rate, per min	Absence	AVPU	Unresponsive	
		Chest rise	+	ECG	STEMI (II, AVL, V1-3)			
		Breathing sounds	gaspings	Body temperature	36.0 C			
		SpO ₂	45%					
Other relevant information								
N/A								
Scenario progression	Effective management				Lifesaver			
Initial Assessment	Check responsiveness				Tap to shoulders and loudly ask: Are you ok, Mum?			
	Check pulse and breath simultaneously				Check carotid pulse and chest movement 5-10 sec			
	Shout for help				activate emergency response, bring emergency kit			
CPR	Perform chest compressions (hands only CPR before barrier device is appeared)				remove clothe from patient's chest Put hands on lower part of sternum Deliver 100-120 chest compressions in 1 min The depth of compressions no less than 5 cm Check full chest recoil after each compression Do not lean on patient chest			
	When barrier device become available start CPR 30:2				1) Deliver 30 chest compressions with: -correct hands placement -perform 30 chest compression no less than 15 sec and no more than 18 sec - the depth of compressions no less then 5 cm - Check full chest recoil after each compression 2) perform two breath with face shield: - the length of one breath = 1 sec - chest must be rise up during each breath -resume chest compressions immediately after two breath, in less then 8-10 seconds			

	Repeat 30:2 CPR cycle again	<ul style="list-style-type: none"> - 30 chest compressions - 2 breath - resume chest compressions immediately after two breath, in less then 8-10 seconds
<p>Criteria for closing the scenario:</p> <ol style="list-style-type: none"> 1) student correctly perform all steps of initial assessment and CPR 2) check pulse and breath a minimum 5 sec but no more then 10 second 3) correct hand placement 4) compressions rate, depth, ratio, minimization of interruption between chest compressions and breath 5) open airway correctly (head tilt-chin lift maneuver), give two breath, one breath over 1 sec, do not hyperventilate, 6) resume chest compressions immediately after two breath, in less then 8-10 seconds 		
<p>Notes: handover and transfer on ICU</p> <p>Discussions after completing simulation:</p> <ol style="list-style-type: none"> 1) Importance of obtaining of relevant background information 2) how recognize cardiac arrest 3) does nurse can initiate CPR 4) Appropriate escalation and call for help 5) TEAM-tool feedback CPR key points 		
<p>Preparations:</p> <p>a training course of Advanced Life Support</p> <p>Instructions to students on agenda, time limits and methods of evaluation.</p> <p>Asking from the student whether they have any limitations: hand or wrist injury, sickness etc.</p>		
<p>Equipment needed:</p> <ul style="list-style-type: none"> - Mannequin " Resusci Anne" - Bag-valve-mask of appropriate size with rebreather - Disposable Face shield - Oropharyngeal airway sizes 4,5,6 - Nasopharyngeal airway sizes 6,7 - Oxygen supply - Suction unit - Gloves - Yankauer mouth catheter - Cardio monitor (HR, RR, BP, SpO₂) - Water-soluble lubricant, - Clipboard - Scenario assessment checklist - Stopwatch - Pencil/marker 		
<p>Instructions for participants and observers:</p> <p>Participants:</p> <p>This in-situ simulation scenario assessment is based on airway management of a simulated patient in respiratory arrest.</p> <p>An assessor will provide you with information not readily reproducible in this environment (e.g. the patient's skin color, respiratory rate, breathing sounds etc); however, within the capabilities of the manikin being used all other data will need to be gathered like it would be required or available in a real on-the-job environment (e.g. you will need to attach the pulse oximeter to the patient in order to determine SpO₂ and pulse and actually assess the observations as it would a real patient).</p> <p>This scenario will be played in real-time and you will be allowed to use all immediately available medical equipment. You will have a co-worker to assist you during this simulation but Major skill tasks must be completed by you. That will include:</p> <ul style="list-style-type: none"> - primary survey - history gathering 		

- decision on nursing intervention
- initial airway management and pulse assessment
- first cycle of chest compressions

Minor skill tasks, such as call for help, attachment of ECG electrodes and pulse oximeter, measurement of blood pressure might be performed by your co-worker at your direction.

NOTE: Your partner is skilled enough but lacks initiative, so you must ask them to perform all skills that you want them to do. Your partner will do everything that you tell them to do, even if what you tell them to do is wrong. However, you will not be lost score if your partner will do something wrong.

The assessor(s) will notify you, at which time you will be requested to deliver an ISBAR Handover using the information that you have collected throughout your simulation scenario and when the simulation will be completed.

Observer:

This scenario will be performed in real-time and you will only observe student's performance without any intervention. Please do not interrupt scenario simulation even if student is doing something wrong or incorrect.

Pre-assignment:

Writing pre-test

Simulation scenario template 3

Scenario Title: and environment:	In-hospital cardiac arrest, Megacode scenario (Bradycardia-Pulseless Ventricular Tachycardia (VT)-ROSC)	
Study unit/target group:	Nurses of Emergency and Intensive Care Unite departments (ED and ICU)	
Learning outcomes (knowledge, skills, attitudes/behaviors):	Technical skills:	Non-technical skills:
	transcutaneous pacing technique (right pads position, to establish right rhythm through pacing, administer right dose of Atropine)	
	Correct recognizing of heart rhythm (bradycardia, Pulsless VF)	To determine indication for transcutaneous pacing
	Correct bag-valve ventilation technique	
	Correct time for checking pulse and breathing (5-10sec) Identifies ROSC	Ability to recognize cardiac arrest, ROSC
		Ability to initiate high quality CPR Confidence behavior due emergency situation Effective team dynamic (chest compression fraction (CCF) – 60-80%)
Participants and roles:	Simulation patient – mannequin Resuscitation team – 5 nurses and one guest, who performs doctor’s role Registered nurse of ED or ICU – assessed person Assistant – 4 nurses from the group and one guest	
Scenario Description		
(I) Identification of the patient and location information (name, age etc.)	Patient Mr. B, Male, 72 y.o. arrived at ED 5 minutes ago. Mannequin “Resusci Anne” by Laerdal. Newly admitted patient, 72 years old male with altered mental status, fatigue, dizziness, bradycardia due to possible b-blockers overdose.	
(S) Current situation (immediate clinical situation, particular issues, concerns or risks)	Emergency Medical Service (EMS) team is delivering a patient with suspicion on possible b-blockers overdose to your Emergency Department. You are dispatched to provide primary survey of he. The patient has an altered mental status.	

(B) Background information (relevant clinical history diagnosis, medications, allergies etc.)	S – The Bradycardia has been evaluated by EMS-team on-scene, ECG is done: sinus bradycardia with Second-degree AV block Type II, troponin test - negative. The symptoms of possible bradycardia have been mentioned 2 hours ago before the present time A - No M – Atenolol 50 mg twice a day. P – he suffers from essential hypertension for last six years L – he had a lunch 2 hours before the present time E – Patient’s next to kin has mentioned, that he has made mistake on dose and has been taking 100 mg tablets twice a day instead 50 mg for 3 days							
(C) Assessment of the situation and observations	EMS team informs you that they gave to him primary care establish IV, maintenance of oxygen							
(R) Recommendations for the professionals/shift, further assessments and actions Required, expected frequency of observations etc.)	Request for immediate assessment and nurse intervention. Notes and clinical information will be gathered for your arrival Further information (if requested) Scene is safe, AVPU – V, BP 80/40 mmHg, Capillary refill – 3 sec, HR 38/min, SpO ₂ - 85% (room air)							
Simulator Setup								
Airway		Breathing		Circulation		Disability		Exposure
Airway Sounds	snoring	Respiratory Rate, breath/minute	9	NIBP, mmHg	80/40	CGS	-	No any injury or major external bleeding
		Respiratory Pattern		Pulse Rate, per min	38/min	AVPU	V-verbal	
		Chest rise	+	ECG	sinus bradycardia with Second-degree AV block Type II			
		Breathing sounds	Clear sounds	Body temperature	36.2 C			
		SpO₂	85%					
Other relevant information								
N/A								
Scenario progression	Effective management				Lifesaver			
Initial Assessment	Check for response				Tap to shoulders and loudly ask: Are you ok, are you ok?			
	ABCDE approach				- Rapid visual inspection of oral cavity; Checking for breathing			
Activation of emergency response	Shout for help				Call for help (resuscitation team) activate emergency response, bring emergency kit, bring defibrillator remove clothe from patient’s chest			
Bradycardia management	To determine indication for bradycardia conditions, identify and treat life-threatening condition				Open patient airway, give oxygen through a face-mask, attach pads and cardiac monitor for rhythm identification, and check BP, RR, HR, and SpO ₂ . Re-check IV access. 12-lead ECG			

		To determine bradycardia cause and treat it. Administrate atropine IV First dose 0.5 mg bolus. Max dose 3 mg. If Atropine ineffective start transcutaneous pacing
VF Management	CAB approach Determine Shockable rhythm Perform CPR 30:2	Deliver 30 chest compressions with: -correct hands placement -perform 30 chest compression no less than 15 sec and no more than 18 sec - the depth of compressions no less then 5 cm - Check full chest recoil after each compression
		perform two breath with face shield: - the length of one breath = 1 sec - chest must be rise up during each breath -resume chest compressions immediately after two breath, in less than 8-10 seconds
		Analyzing heart rhythm, deliver first dose of Shock. Make sure that everybody clear
		Immediately resume CPR after shock
		Administer medication: adrenaline 0.1 mg IV, Amiodarone 300 mg IV
Post-cardiac arrest care	Management of ROSC	- Check pulse, breath and consciousness - Consider advanced airway - Treat hypotension, IV bolus - Consider treatable causes (b-blockers overdose) - 12-Lead ECG
Criteria for closing the scenario: 1) Students correctly perform all steps of Megacode scenario 2) Team-leader has decided refer patient to ICU		
Notes: handover and transfer on ICU Discussions after completing simulation: <ol style="list-style-type: none"> 1 Importance of obtaining of relevant background information 2 how recognize bradycardia, VF, cardiac arrest 3 does nurse can initiate and lead of CPR 4 Appropriate escalation and call for help 5 Effective team dynamic 6 TEAM-tool feedback CPR, Management of Bradycardia, VF key points		
Preparations: a training course of Advanced Life Support Instructions to students on agenda, time limits and methods of evaluation. Asking from the student whether they have any limitations: hand or wrist injury, sickness etc.		
Equipment needed: <ul style="list-style-type: none"> • Mannequin " Resusci Anne" • Bag-valve-mask of appropriate size with rebreather • Disposable Face shield • Oropharyngeal airway sizes 4,5,6 • Nasopharyngeal airway sizes 6,7 • Oxygen supply • Suction unit • Gloves • Yankauer mouth catheter • Cardio monitor (HR, RR, BP, SpO2) • Defibrillator with pacing • Medications • Water-soluble lubricant, 		

- Clipboard
- Scenario assessment checklist
- Stopwatch
- Pencil/marker

Instructions for participants and observers:

Participants:

This in-situ simulation scenario assessment is based on airway management of a simulated patient in respiratory arrest.

An assessor will provide you with information not readily reproducible in this environment (e.g. the patient's skin color, respiratory rate, breathing sounds etc); however, within the capabilities of the manikin being used all other data will need to be gathered like it would be required or available in a real on-the-job environment (e.g. you will need to attach the pulse oximeter to the patient in order to determine SpO₂ and pulse and actually assess the observations as it would a real patient).

This scenario will be played in real-time and you will be allowed to use all immediately available medical equipment. You will have a co-worker to assist you during this simulation but Major skill tasks must be completed by you. That will include:

- 1 primary survey
- 2 history gathering
- 3 decision on nursing intervention
- 4 initial airway management and pulse assessment
- 5 first cycle of chest compressions

Minor skill tasks, such as call for help, attachment of ECG electrodes and pulse oximeter, measurement of blood pressure might be performed by your co-worker at your direction.

NOTE: Your partner is skilled enough but lacks initiative, so you must ask them to perform all skills that you want them to do. Your partner will do everything that you tell them to do, even if what you tell them to do is wrong. However, you will not be lost score if your partner will do something wrong.

The assessor(s) will notify you, at which time you will be requested to deliver an ISBAR Handover using the information that you have collected throughout your simulation scenario and when the simulation will be completed.

Observer:

This scenario will be performed in real-time and you will only observe student's performance without any intervention. Please do not interrupt scenario simulation even if student is doing something wrong or incorrect.

Pre-assignment:

Writing pre-test

Simulation scenario template 4

Scenario Title: and environment:	In-hospital cardiac arrest, Megacode scenario (Ventricular fibrillation (VF) - Pulsless Ventricular Tachycardia (VT)-ROSC)	
Study unit/target group:	Nurses of Emergency and Intensive Care Unite departments (ED and ICU)	
Learning outcomes (knowledge, skills, attitudes/behaviors):	Technical skills:	Non-technical skills:
	Verify heart rhythm	Ability to recognize cardiac arrest, ROSC
	Use manual defibrillator, deliver a shock	To recognize shockable and non-shockable rhythm
	Correct bag-valve ventilation technique	Ability to initiate high quality CPR
	Correct time for checking pulse and breathing (5-10sec)	Confidence behavior due emergency situation
	Identifies ROSC	Effective team dynamic (chest compression fraction (CCF) – 60-80%) to be able explain an appropriate dose of medications
Participants and roles:	Simulation patient – mannequin Resuscitation team – 5 nurses and one guest, who performs doctor’s role Registered nurse of ED or ICU – assessed person Assistant – 4 nurses from the group and one guest	
Scenario Description		
(I) Identification of the patient and location information (name, age etc.)	Patient Ms. C, Female, 22 y.o. arrived at ED 10 minutes ago. Mannequin “Resusci Anne” by Laerdal. Newly admitted patient, 22 years old female with chest pain, short breathness, fatigue, dizziness, heart palpitation, open fracture of low left limb (possible fracture of tibia) due to possible Pulmonary Thromboses (Fat embolism)	
(S) Current situation (immediate clinical situation, particular issues, concerns or risks)	Emergency Medical Service (EMS) team delivering a patient with suspicion on Pulmonary Thromboses (Fat embolism) to your Emergency Department. You are dispatched to provide primary survey of her. The patient has an altered mental status	
(B) Background information (relevant clinical history diagnosis, medications, allergies etc.)	S – The open fracture of low left limb (possible fracture of tibia) has been evaluated by EMS-team on-scene, ECG is done: sinus tachycardia. Patient has received injury 30 min ago, when she was playing on soccer. A - No M – oral hormonal contraceptives P – no any significant problem with health L – he had a breakfast 6 hours before the present time E – Patient has received injury 30 min ago, when she was playing on soccer	
(D) Assessment of the situation and observations	EMS team informs you that they gave to him primary care establish IV, apply immobilization	

(R) Recommendations for the professionals/shift, further assessments and actions Required, expected frequency of observations etc.)		Request for immediate assessment and nurse intervention. Notes and clinical information will be gathered for your arrival. Further information (if requested) Scene is safe, AVPU – V, BP 100/40 mmHg, Capillary refill – 3 sec, HR 148/min, SpO ₂ - 82% (room air), RR - 29/min						
Simulator Setup								
Airway		Breathing		Circulation		Disability		Exposure
Airway Sounds	open	Respiratory Rate, breath/min	29	NIBP, mmHg	100/40	CGS	-	open fracture of low left limb (possible fracture of tibia)
		Respiratory Pattern	short breathness, shallow	Pulse Rate, per min	148/min	AVPU	V-verbal	
		Chest rise	+	ECG	sinus tachycardia			
		Breathing sounds	crackles	Body temperature	37.2 C			
		SpO₂	82%					
Other relevant information								
N/A								
Scenario progression	Effective management			Lifesaver				
Initial assessment	Check for response			Tap to shoulders and loudly ask: Are you ok, are you ok?				
	ABCDE approach			Rapid visual inspection of oral cavity Checking for breathing				
Activation of emergency response	Shout for help			Call for help (resuscitation team) activate emergency response, bring emergency kit, bring defibrillator remove clothe from patient's chest				
Obstructive Shock management	Determine signs of pulmonary thrombosis and tachycardia conditions, identify and treat life-threatening condition			Open patient's airway				
				Give oxygen through the face-mask				
				Attach pads and cardiac monitor for rhythm identification Check BP, RR, HR, SpO ₂ . Re-check IV access. 12-lead ECG				
VF Management	CAB approach			Determine cause of life-threatening condition and treat it. Consider advanced airway if need				
	Determine Shockable rhythm			Analyzing heart rhythm, deliver first dose of Shock. Make sure that everybody clear				
				Immediately resume CPR after shock Administer medication: adrenaline 0.1 mg IV, Amiodarone 300 mg IV				
	Perform CPR 30:2			Deliver 30 chest compressions with: -correct hands placement -perform 30 chest compression no less than 15 sec and no more than 18 sec - the depth of compressions no less then 5 cm				

		<ul style="list-style-type: none"> - Check full chest recoil after each compression Perform two breath with face shield: - the length of one breath = 1 sec - chest must be rise up during each breath -resume chest compressions immediately after two breath, in less then 8-10 seconds
Post-cardiac arrest care	Recognize ROSC	<ol style="list-style-type: none"> 1) Check pulse, breath and consciousness 2) consider advanced airway 3) treat hypotension, IV bolus 4) Consider treatable causes (b-blockers overdose) 5) 12-Lead ECG
<p>Criteria for closing the scenario:</p> <ol style="list-style-type: none"> 1) Students correctly perform all steps of Megacode scenario 2) Team-leader has decided to refer patient to ICU 		
<p>Notes: handover and transfer on ICU Discussions after completing simulation:</p> <ol style="list-style-type: none"> 1 Importance of obtaining of relevant background information 2 how recognize bradycardiya, VF, cardiac arrest 3 does nurse can initiate and lead of CPR 4 Appropriate escalation and call for help 5 Effective team dynamic 6 TEAM-tool feedback <p>CPR, Management of pulmonary thrombosis, VF key points</p>		
<p>Preparations: a training course of Advanced Life Support Instructions to students on agenda, time limits and methods of evaluation. Asking from the student whether they have any limitations: hand or wrist injury, sickness etc.</p>		
<p>Equipment needed:</p> <ol style="list-style-type: none"> 7 Mannequin " Resusci Anne" 8 Bag-valve-mask of appropriate size with rebreather 9 Disposable Face shield 10 Oropharyngeal airway sizes 4,5,6 11 Nasopharyngeal airway sizes 6,7 12 Oxygen supply 13 Suction unit 14 Glovers 15 Yankauer mouth catheter 16 Cardio monitor (HR, RR, BP, SpO₂) 17 Defibrillator with pacing 18 Medications 19 Water-soluble lubricant, 20 Clipboard 21 Scenario assessment checklist 22 Stopwatch 23 Pencil/marker 		
<p>Instructions for participants and observers:</p> <p>Participants: This in-situ simulation scenario assessment is based on airway management of a simulated patient in respiratory arrest. An assessor will provide you with information not readily reproducible in this environment (e.g. the patient's skin color, respiratory rate, breathing sounds etc); however, within the capabilities of the manikin being used all other data will need to be gathered like it would be required or available in a real on-the-job environment (e.g. you will need to attach the pulse oximeter to the patient in order to determine SpO₂ and pulse and actually assess the observations as it would a real patient). This scenario will be played in real-time and you will be allowed to use all immediately available medical equipment. You will have a co-worker to assist you during this simulation butMajor skill tasks must be completed by you. That will include:</p> <ul style="list-style-type: none"> • primary survey 		

- history gathering
- decision on nursing intervention
- initial airway management and pulse assessment
- first cycle of chest compressions

Minor skill tasks, such as call for help, attachment of ECG electrodes and pulse oximeter, measurement of blood pressure might be performed by your co-worker at your direction.

NOTE: Your partner is skilled enough but lacks initiative, so you must ask them to perform all skills that you want them to do. Your partner will do everything that you tell them to do, even if what you tell them to do is wrong. However, you will not be lost score if your partner will do something wrong.

The assessor(s) will notify you, at which time you will be requested to deliver an ISBAR Handover using the information that you have collected throughout your simulation scenario and when the simulation will be completed.

Observer:

This scenario will be performed in real-time and you will only observe student's performance without any intervention. Please do not interrupt scenario simulation even if student is doing something wrong or incorrect.

Pre-assignment:

Writing pre-test

Simulation scenario template 5

Scenario Title: and environment:	In-hospital cardiac arrest, Megacode scenario (Tachycardia-PEA-VF-ROSC)	
Study unit/target group:	Nurses of Emergency and Intensive Care Unite departments (ED and ICU)	
Learning outcomes (knowledge, skills, attitudes/behaviors):	Technical skills:	Non-technical skills:
	Correct chest compression technique (depth, hands placement, ratio, frequency)	Effective team dynamic (chest compression fraction (CCF) – 60-80%)
	Correct mouth-to-mouth ventilation technique	
	Correct time for checking pulse and breathing (5-10sec)	Ability to initiate high quality CPR
	Recognition of ROSC	Confident behavior at emergencies
	Manual defibrillator operation	Ability to recognize shockable and non-shockable rhythms
		Ability to administer appropriate medications in appropriate dosages
Recognition of heart rhythm	Ability to recognize possible cardiac arrest and, ROSC	
Participants and roles:	Simulation patient – mannequin Resuscitation team is 6 people – 5 nurses and 1 guest performing doctor's role Registered nurse of ED or ICU – assessed person	
Scenario Description		
(I) Identification of the patient and location information (name, age etc.)	Patient Mrs. A, Female, 24 y.o. has just arrived at ED. Mannequin “Resusci Anne” by Laerdal. Newly admitted patient, 24 years old female with short breathing and stridor, altered mental status	
(S) Current situation (immediate clinical situation, particular issues, concerns or risks)	Emergency Medical Service (EMS) team delivering a patient with suspicion on anaphylaxis shock to your Emergency Department. You are dispatched to provide primary survey of her. The patient has just suddenly collapsed in front of you and currently is lying on the floor. The Scene is safe	
(B) Background information (relevant clinical history diagnosis, medications, allergies etc.)	S – The anaphylaxis shock. A - No M – no P – no any significant problem with her health L – She had breakfast 2 hours before the present time E – Pt was stung by bee 20 min ago	
(E) Assessment of the situation and observations	EMS team informs you that they gave to her primary care according, but she is “getting worse”, Blood pressure has decreased from 120/80 to 70/50mmHg for that time after administration 2 dose of Epinephrine by EpiPen.	
(R) Recommendations for the professionals/shift, further assessments and actions Required, expected frequency of observations etc.)	Request for immediate assessment and nurse intervention. Notes and clinical information will be gathered for your arrival. Further information (if requested) Scene is safe, nobody start CPR or call for help	
Simulator Setup		

Airway		Breathing		Circulation		Disability		Exposure
Airway Sounds	Stridor	Respiratory Rate, breath/min	32	NIBP, mmHg	70/50	CGS	-	Cyanosis, skin is dry, warm, capillary refill - brisk
		Respiratory Pattern		Pulse Rate, per min	154	AVPU	verbal	
		Chest rise	+	ECG				
		Breathing sounds	wheezes	Body temperature	37°C			
		SpO₂	65% room air					
Other relevant information								
N/A								
Scenario progression	Effective management	Lifesaver						
Initial assessment	Check responsiveness	Tap to shoulders and loudly ask: Are you ok, are you ok?						
	ABCDE approach	Rapid visual inspection of oral cavity Checking for breathing						
Activation of emergency response	Shout for help	activate emergency response, bring emergency kit remove clothe from patient's chest						
Anaphylaxis Shock management	To identify signs of anaphylaxis and symptomatic tachycardia with pulse	Open patient's airway, give oxygen with face-mask, attach pads of cardiac monitor for rhythm check, obtain BP, RR, HR, and SpO ₂ . Put IV access, bolus 1600 ml/20 min. Obtain 12-lead ECG						
	Identify and treat potentially life-threatening conditions	Find out tachycardia cause and manage that.						
		Consider nebulizer with salbutamol						
		Administrate adrenaline 0.5 mg IM						
PEA Management	CAB approach	Check for carotid pulse						
		Immediately start CPR <ul style="list-style-type: none"> • Deliver 30 chest compressions with: • correct hands placement • perform 30 chest compression no less than in 15 sec and no more than in 18 sec <ul style="list-style-type: none"> - the depth of compressions no less than 5 cm - ensure full chest recoil after each compression • perform two breaths with face shield: <ul style="list-style-type: none"> - the duration of each breath is 1 sec - chest must rise up at each breath - resume chest compressions immediately after two breaths, interruption in compressions shall be less than 10 sec 						
VF Management	Determine Shockable rhythm	After 2 minutes of CPR analyze heart rhythm, no need shock						

	Perform CPR 30:2 Determine Shockable rhythm	Immediately resume CPR Identify and treat reversible causes Consider Advanced Airway (ETT) 1 breath in 6 sec Administer medication appropriately: Adrenaline 0.1 mg IV after 2 nd Shock, analyze heart rhythm, deliver appropriate Shock. Make sure that everybody clear Immediately resume CPR after shock Administer medication appropriately: Adrenaline 0.1 mg IV after, Amiodarone 300 mg IV after 3 rd Shock
Post-cardiac arrest care	Management of ROSC	1) Check for carotid pulse, breathing and consciousness 2) Consider advanced airway 3) Control hypotension(IV bolus) 4) Identify and manage treatable causes (b-blockers overdose) 5) Obtain 12-Lead ECG
Criteria for closing the scenario: 1) The student performs all steps of Megacode scenario listed above correctly 2) The student decides to refer patient to ICU		
Notes: handover and transfer on ICU Discussions after completion of simulation: <ul style="list-style-type: none"> • Importance of obtaining of relevant background information • How recognize cardiac arrest? • Can nurse initiate CPR? • Appropriate escalation and call for help TEAM-tool feedback CPR, Management of anaphylaxis, VF and PEA key points		
Preparations: Advanced Life Support training Instructions to students on agenda, time limits and methods of evaluation. Asking from the student whether they have any limitations: hand or wrist injury, sickness etc.		
Equipment needed: <ol style="list-style-type: none"> 1. Mannequin " Resusci Anne" 2. Bag-valve-mask of appropriate size with rebreather 3. Disposable face shield 4. Oropharyngeal airway sizes 4,5,6 5. Nasopharyngeal airway sizes 6,7 6. Oxygen supply 7. Suction unit 8. Glovess 9. Yankauer mouth catheter 10. Cardio monitor (HR, RR, BP, SpO2) 11. Defibrillator with pacing 12. Medications 13. Water-soluble lubricant 14. Clipboard or whiteboard 15. Scenario assessment checklist 16. Stopwatch 17. Pencil/marker 		

Instructions for participants and observers:**Participants:**

This in-situ simulation scenario assessment is based on airway management of a simulated patient in respiratory arrest.

An assessor will provide you with information not readily reproducible in this environment (e.g. the patient's skin color, respiratory rate, breathing sounds etc); however, within the capabilities of the manikin being used all other data will need to be gathered like it would be required or available in a real on-the-job environment (e.g. you will need to attach the pulse oximeter to the patient in order to determine SpO₂ and pulse and actually assess the observations as it would a real patient).

This scenario will be played in real-time and you will be allowed to use all immediately available medical equipment. You will have a co-worker to assist you during this simulation but Major skill tasks must be completed by you. That will include:

1. primary survey
2. history gathering
3. decision on nursing intervention
4. initial airway management and pulse assessment
5. first cycle of chest compressions

Minor skill tasks, such as call for help, attachment of ECG electrodes and pulse oximeter, measurement of blood pressure might be performed by your co-worker at your direction.

NOTE: Your partner is skilled enough but lacks initiative, so you must ask them to perform all skills that you want them to do. Your partner will do everything that you tell them to do, even if what you tell them to do is wrong. However, you will not be lost score if your partner will do something wrong.

The assessor(s) will notify you, at which time you will be requested to deliver an ISBAR Handover using the information that you have collected throughout your simulation scenario and when the simulation will be completed.

Observer:

This scenario will be performed in real-time and you will only observe student's performance without any intervention. Please do not interrupt scenario simulation even if student is doing something wrong or incorrect.

Pre-assignment:

Writing pre-test

Simulation scenario template 6

Scenario Title: and environment:	In-hospital cardiac arrest, Megacode scenario (Bradycardia-Asystole-ROSC)							
Study unit/target group:	Nurses of Emergency and Intensive Care Unite departments (ED and ICU)							
Learning outcomes (knowledge, skills, attitudes/behaviors):	Technical skills:			Non-technical skills:				
	Correct chest compression technique (depth, hands placement, ratio, frequency)			Ability to initiate high quality CPR Effective team dynamic (chest compression fraction (CCF) – 60-80%)				
	Correct mouth-to mouth ventilation technique							
	Correct time for checking pulse and breathing (5-10sec)			Ability to recognize possible cardiac arrest and, ROSC				
	Recognition of ROSC Manual defibrillator operation			Confident behavior at emergencies				
	Recognition of heart rhythm			Ability to administer appropriate medications in appropriate dosages Ability to recognize shockable and non-shockable rhythms				
Participants and roles:	Simulation patient – mannequin The resuscitation team is 6 people – 5 nurses and 1 guest performing doctor’s role Registered nurse of ED or ICU – assessed person							
Scenario Description								
(I) Identification of the patient and location information (name, age etc.)	Patient Mr. K, Male, 21 y.o. has just arrived at ED. Mannequin “Resusci Anne” by Laerdal. Newly admitted patient, 21 years old male with respiratory arrest and bradycardia, unconscious.							
(S) Current situation (immediate clinical situation, particular issues, concerns or risks)	Emergency Medical Service (EMS) team delivering a patient with suspicion on opioid overdose to your Emergency Department. You are dispatched to provide primary survey of her. Pt ia lying on ambulance stretchers, EMS stuff is performing BVM. The Scene is safe.							
(B) Background information (relevant clinical history diagnosis, medications, allergies etc.)	S – possible opioid overdose. Respiratory arrest. Pinpoint pupils A - No M – possible take opioids P – no any significant problem with his health L – no data E – Pt was found by his roommate 10 min ago							
(A) Assessment of the situation and observations	EMS team informs you that they gave to him primary care according guideline							
(R) Recommendations for the professionals/shift, further assessments and actions Required, expected frequency of observations etc.)	Request for immediate assessment and nurse intervention. Notes and clinical information will be gathered for your arrival. Further information (if requested) Scene is safe, nobody start CPR or call for help							
Simulator Setup								
Airway		Breathing		Circulation		Disability		Exposure
Airway	absent	Respiratory Rate,	BVM	NIBP, mmHg	80/40	CGS	-	

Sounds		breath/min					
		Respiratory Pattern	-	Pulse Rate, per min	42	AVPU	Unresponsive
		Chest rise	+	ECG			
		Breathing sounds	+	Body temperature	37°C		
		SpO₂	95% oxygen 5l/min				

Other relevant information

N/A

Scenario progression	Effective management	Lifesaver
Initial assessment	Check for response	Tap to shoulders and loudly ask: Are you ok, are you ok?
	CAB approach	Checking for breathing and carotid pulse remove clothe from patient's chest
Activation of emergency response	Shout for help	activate emergency response, bring emergency kit
Opioid associated life-threatening emergency response	To identify signs of opioid overdose and symptomatic bradycardia with pulse Identify and treat potentially life-threatening conditions	1) Open patient's airway, give rescue breath with Ambu-bag, attach pads of cardiac monitor for rhythm check, obtain BP, RR, HR, and SpO ₂ . Put IV access. Obtain 12-lead ECG 2) Administer naloxone and monitor response 3) Find out bradycardia cause and manage that. 3) continue rescuer breathing and check pulse every 2 min
Asystole Management	Perform CPR 30:2	1) Check for carotid pulse 2) Immediately start CPR 3) Deliver 30 chest compressions with: <ul style="list-style-type: none"> • correct hands placement • perform 30 chest compression no less than in 15 sec and no more than in 18 sec • the depth of compressions no less than 5 cm • Ensure full chest recoil after each compression 4) Perform two breaths with face shield <ul style="list-style-type: none"> • the duration of each breath is 1 sec • chest must rise up at each breath 5) Resume chest compressions immediately after two breaths, interruption in compressions shall be less than 10 sec
	Determine non-Shockable rhythm	1) After 2 minutes of CPR analyze heart rhythm, no need shock 2) Immediately resume CPR Identify and treat reversible causes 3) Consider Advanced Airway (LM) 1 breath in 6 sec 4) Administer medication appropriately: Adrenaline 0.1 mg IV after 2 nd Shock,

Post-cardiac arrest care	Management of ROSC	<ol style="list-style-type: none"> 1) Check for carotid pulse, breathing and consciousness 2) Consider advanced airway if not yet 3) Control hypotension (IV bolus) 4) Identify and manage treatable causes (b-blockers overdose) 5) Obtain 12-Lead ECG
	Check responsiveness	Tap to shoulders and loudly ask: Are you ok, are you ok?
<p>Criteria for closing the scenario:</p> <ol style="list-style-type: none"> 1) The student performs all steps of Megacode scenario listed above correctly 2) The student decides to refer patient to ICU 		
<p>Notes: handover and transfer on ICU Discussions after completion of simulation:</p> <ul style="list-style-type: none"> • Importance of obtaining of relevant background information • How recognize cardiac arrest? • Can nurse initiate CPR? • Appropriate escalation and call for help <p>TEAM-tool feedback CPR, Management of opioid overdose, bradycardia and asystole key points</p>		
<p>Preparations:</p> <ul style="list-style-type: none"> • Advanced Life Support training <p>Instructions to students on agenda, time limits and methods of evaluation. Asking from the student whether they have any limitations: hand or wrist injury, sickness etc.</p>		
<p>Equipment needed:</p> <ol style="list-style-type: none"> 1. Mannequin "Resusci Anne" 2. Bag-valve-mask of appropriate size with rebreather 3. Disposable face shield 4. Oropharyngeal airway sizes 4,5,6 5. Nasopharyngeal airway sizes 6,7 6. Oxygen supply 7. Suction unit 8. Gloves 9. Yankauer mouth catheter 10. Cardio monitor (HR, RR, BP, SpO₂) 11. Defibrillator with pacing 12. Medications 13. Water-soluble lubricant 14. Clipboard or whiteboard 15. Scenario assessment checklist 16. Stopwatch 17. Pencil/marker 		
<p>Instructions for participants and observers:</p> <p>Participants: This in-situ simulation scenario assessment is based on airway management of a simulated patient in respiratory arrest. An assessor will provide you with information not readily reproducible in this environment (e.g. the patient's skin color, respiratory rate, breathing sounds etc); however, within the capabilities of the manikin being used all other data will need to be gathered like it would be required or available in a real on-the-job environment (e.g. you will need to attach the pulse oximeter to the patient in order to determine SpO₂ and pulse and actually assess the observations as it would a real patient). This scenario will be played in real-time and you will be allowed to use all immediately available medical equipment. You will have a co-worker to assist you during this simulation but Major skill tasks must be completed by you. That will include:</p> <ol style="list-style-type: none"> 1. primary survey 2. history gathering 3. decision on nursing intervention 4. initial airway management and pulse assessment 5. first cycle of chest compressions 		

Minor skill tasks, such as call for help, attachment of ECG electrodes and pulse oximeter, measurement of blood pressure might be performed by your co-worker at your direction.
NOTE: Your partner is skilled enough but lacks initiative, so you must ask them to perform all skills that you want them to do. Your partner will do everything that you tell them to do, even if what you tell them to do is wrong. However, you will not be lost score if your partner will do something wrong.

The assessor(s) will notify you, at which time you will be requested to deliver an ISBAR Handover using the information that you have collected throughout your simulation scenario and when the simulation will be completed.

Observer:

This scenario will be performed in real-time and you will only observe student's performance without any intervention. Please do not interrupt scenario simulation even if student is doing something wrong or incorrect.

Pre-assignment:

Writing pre-test

Appendix 3. The General nurses questionnaire

1) FULL Name

2) Age

3) Education (Medical college/ bachelor)

4) Work experience in the specialty

5) Have you previously studied at the BLS course?

6) Have you previously studied at the ACLS course?

7) If you answered "Yes" to question 5 and/or 6 then indicate the certain date (date, month, year) of the last training

8) How long have you been working at the ED / ICU?

9) What is the date when you last participated in-hospital cardiac arrest CPR

12) Have you previously participated in simulated scenarios / exercises? If so, kindly write type of activity and date?

13) When did you refresh you qualification certificate? If yes, please indicate the subject

Appendix 4. Self-evaluation questionnaire of the nurses
confidence

1) I am sure that I know correct place of my hands on the patient's chest for performing the chest compressions

A - Totally Disagree

B - I do not agree

C – not sure

D-Agree

E - Totally Agree

2) I am confident that I can participate in CPR

A - Totally Disagree

B - I do not agree

C – not sure

D-Agree

E - Totally Agree

3) I am confident that I can be useful for resuscitation team

A - Totally Disagree

B - I do not agree

C – not sure

D-Agree

E - Totally Agree

4) I am sure that I know how to recognize a cardiac arrest in a patient

A - Totally Disagree

B - I do not agree

C – not sure

D-Agree

E - Totally Agree

5) I am confident that I can initiate CPR by myself

A - Totally Disagree

B - I do not agree

C – not sure

D-Agree

E - Totally Agree

6) I am confident that I know whole algorithm of CPR

A - Totally Disagree

B - I do not agree

C – not sure

D-Agree
E - Totally Agree

7) I am confident that I can do whole algorithm of CPR correctly

A - Totally Disagree

B - I do not agree

C – not sure

D-Agree

E - Totally Agree

Appendix 5. ISS skills's checklist

participant number		action	result	done	fail	partially	norm	max score	100%	value of action	
initial response	preparedness	1	scene survey		2	0	1		42	5%	4%
		2	PPE		2	0	1			5%	
		3	Danger		2	0	1			5%	
		4	additional resources, manpower		2	0	1			5%	
primary assessment	primary assessment	5	consciousness, pulse, breath, call for help		2	0	1	10 sec		5%	10%
CPR	quality of chest compression	6	correct hands placement for chest compression		2	0	1			5%	20%
		7	initiate of first chest compression time		2	0	1	18sec		5%	
		8	time for 30 chest compressions		2	0	1	15-18 sec		5%	
		9	depth of compressions		2	0	1	5-6 cm		5%	
	breath/ventilation	10	chest rising		2	0	1			5%	10%
		11	time for 2 breath		2	0	1	8-10 sec		5%	
		12	correct insertion of LM/ETT		2	0	1			5%	
		13	frequency of ventilation		2	0	1			5%	
	Defibrillation	14	2-minutes interval		2	0	1	2 min		5%	16%
		15	recognition of heart rhythm		2	0	1			5%	
		16	energy dose		2	0	1			5%	
		17	early defibrillation		2	0	1			5%	
	appropriate timing interval	18	switch roles		2	0	1			5%	5%

	IV and administration of medication	19	timing of adrenaline		2	0	1	3-5 min		5%	10%
		20	timing of amiodarone		2	0	1	3 and 4 circle		5%	
	quality of CPR	21	effective time dynamic (chest compression fraction)		2	0	1	60-80 %		5%	20%
general impression	confidence	22	was confident/has doubt/was nervous/bother		2	0	1				5%